Lesson no. 21 Banana.

Banana is a very cheap famous fruit all around the world; available all season; famous for its nutrition values, health benefits, can be by all, diabetes patients should not eat it much, best for children, sports persons, athletes, best before & after exercise, best to increase stamina & energy level, improves exercise & sports performances etc. It is mentioned in Quran; please read my English book part 2 lesson no. 32 page 20 onwards or visit my website www.tib-e-nabi-for-you.com or direct link to lesson banana http://www.tib-e-nabi-for-you.com/banana.html

- **NAMES: -**

1. Quranic name is Talh (وطلح منضود) Reference according to Hazrat Ali & Ibn Abbas رضي الله عنه
2. Arabic name is Mawz.
3. In Yemen it is called as Talh.
4. In Hindi & Urdu it is called as Kela.
5. In English it is called as Banana.
6. It belongs to Musaceae
7. Latin name for banana is Musa & there are many types of banana & names differ as Musa acuminata and Musa balbisiana.

- ***Chapter No. 56 Surah Waaqia verse no. 27 to 30: -***

Allah ﷻ says in above verses, about the rewards, to those on the right & they will be those on the right hand (they will be) among sidr (سدر) throne-less (lote) tree & among (وطلح منضود) *TALH* trees with fruits pilled one above another & in shades long extended.

وَأَصْحَابُ الْيَمِينِ ۙ مَا أَصْحَابُ الْيَمِينِ ﴿٢٧﴾ فِي سِدْرٍ مَّخْضُودٍ ﴿٢٨﴾ وَطَلْحٍ مَّنضُودٍ ﴿٢٩﴾ وَظِلٍّ مَّمْدُودٍ ﴿٣٠﴾

Means the right path people will get their account (Naama-e-Aamaal) on the day of Qayamah on their right hand & these people will be people of Paradise (Jannah). Those who will get their account (nam-e-aamaal) in left hand will be people of hell (Janhnum). (*Chapter No. 56 (Surah) Waaqia verse no. 27 to 30*)

- ***References & characters of Banana tree: -***

1. Al-Tabari says that the phrase in the verse no. 28 means tree loaded with fruits & no throne (on the tree).
2. Hazrat Ibn Abbas رضی اللہ عنہما narrates that, verse no. 29 means loaded with fruits & Hazrat Ikrimah ﷺ said, regarding verse no. 28, & 29, they means that they have no thrones & Talh are fruits pilled one above another.
3. The respected companion of Prophet ﷺ & Tab'ieen رحمهم الله says that *Talh* is Banana & Hazrat Ali & Ibn Abbas رضی اللہ عنہما says that Talh is Banana & Hazrat Abu Saeed Al-khudri ﷺ says that Talh refers to banana & the people of Yemen call Banana as Talh.

- ***Conclusion: -***

1. The Talh tree mentioned in *Chapter No. 56 (Surah) Waaqia* is tree of Paradise (Jannah). It is a reward from Allah ﷻ to the righteous people. The description given in *Chapter No. 56 (Surah) Waaqia* verse no. 27 to 34, matches with 3 types of trees:

1. Banana tree,
2. Acacia Seyal (babul),
3. Sidr (سدر) (lote tree) (Jujube)

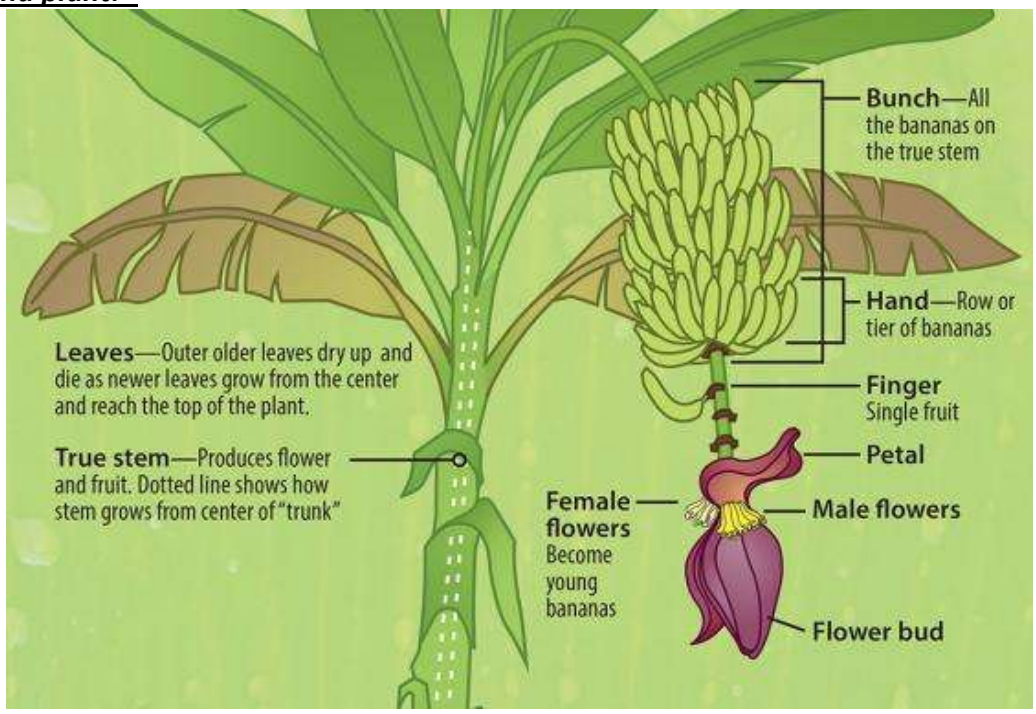
2. I do not say that the Talh tree mentioned in *Chapter No. 56 (Surah) Waaqia* are among above tree. But I only try to explain that the character matches with the above plants or trees. Please keep your mind broad.

3. It may be confusing to many people, but there are some possible reasons, Allah ﷻ's verses are for the whole world & all time. Allah ﷻ wants us to research, learn & gain knowledge.

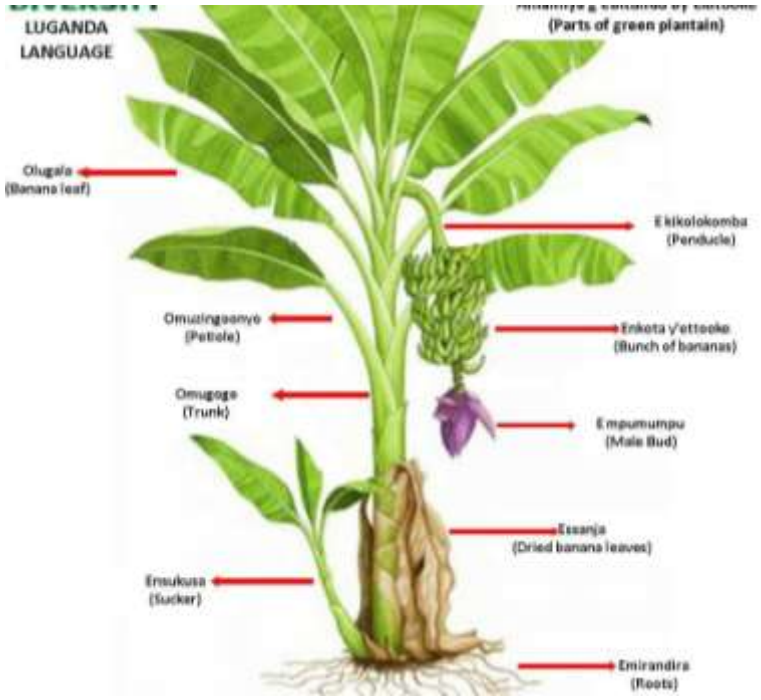
- ***Sayings About banana: -***

1. It is known as Food of philosophers.
2. A banana a day keeps ulcers away.
3. It is known as an Excellent & smart mineral Food.
4. It is known as main sources of nutrition.
5. It is food of Intelligent.
6. Each 100mg of banana is equivalent to 100mg of meat.
7. It is known as the best food for vegetarians.

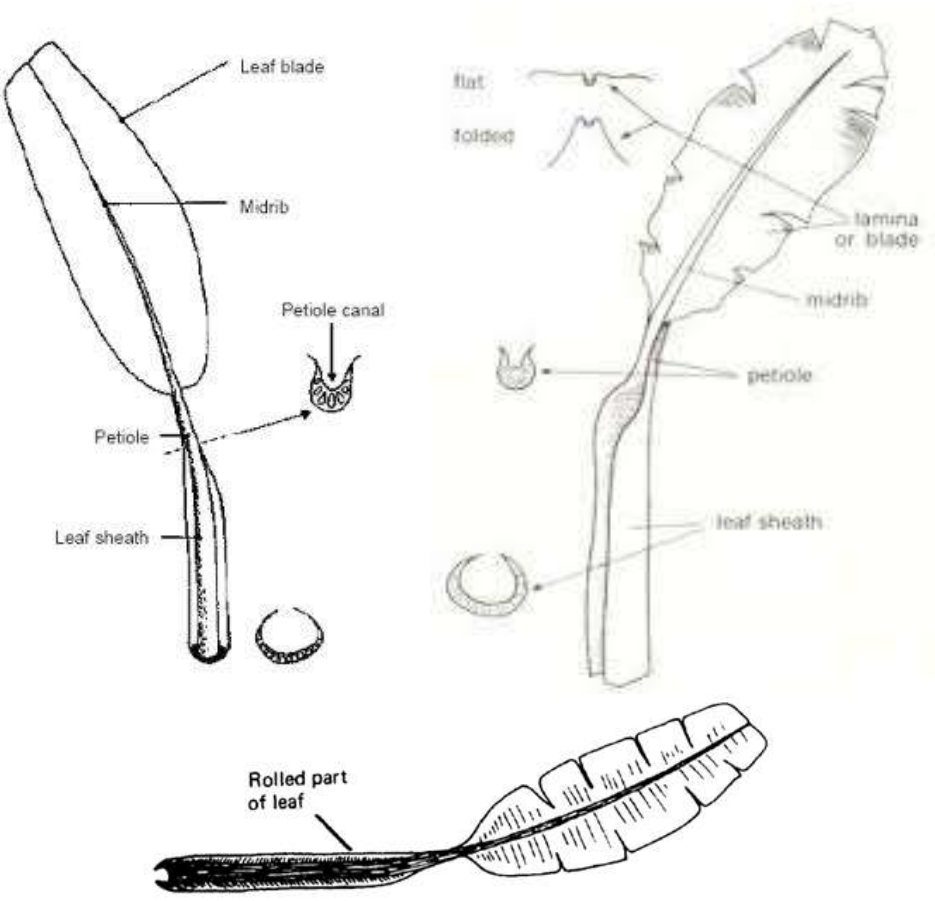
- ***Basic encyclopedia of banana: -***
- ***Banana plant: -***



The banana plant is flowering herbaceous perennial plant. It is an herb because it does not have woody tissues and the aerial parts of the parent plant die down to the ground after the growing season. It is a perennial because one of the offshoots growing at the base of the plant, the sucker, then takes over. The parent plant and its suckers form what is commonly called a mat, or stool, the botanical term is genet. The trunk is not a woody stem but a pseudostem, a compact masse of overlapping and spirally arranged leaf sheaths. Most of the 'true' stem is inside the pseudostem. Fruiting starts on the rhizome and ends with the meristem in the male bud (if present). Wild species of bananas share the same body plant as cultivated bananas, except that they reproduce through both seeds and suckers. Please see the pic below. The optimum temperature is 31 or 32°C, during the summer, plant may produce 4 or 5 leaves a month;



- ***<u>Banana leaves: -</u>***



The leaf is the main photosynthetic organ. Each leaf emerges from the center of the pseudostem as a rolled cylinder (see cigar leaf below). The distal end of the elongating leaf sheath contracts into a petiole, that is more or less open depending on the cultivar. The petiole becomes the midrib, which divides the blade into two lamina halves. The upper surface of the leaf is called adaxial while the lower one is called abaxial.

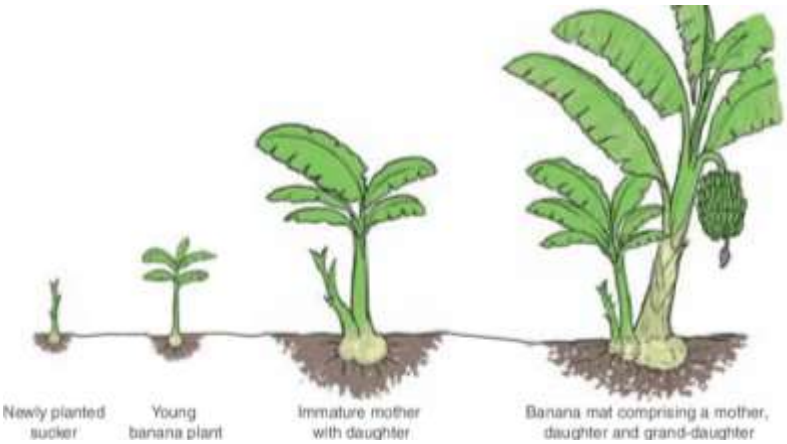
The first rudimentary leaves produced by a growing sucker are called scale leaves. Mature leaves that consist of sheath, petiole, midrib and blade are called foliage leaves.
Lamina veins run parallel to each other in a long S shape from midrib to margin. Veins do not branch, which results in leaves tearing easily.

- ***Cigar leaf: -***

The cigar leaf is a recently emerged leaf still rolled as a cylinder. The lapse of time in which a leaf unfolds varies. Under favourable climatic conditions, it takes about seven days, but it can take up to 15 to 20 days under poor conditions. The new leaf is tightly coiled, whitish, and particularly fragile. The extension at the tip of the leaf is called the precursory appendage. After emergence, it withers and falls off.

- ***Sucker: -***

sword sucker

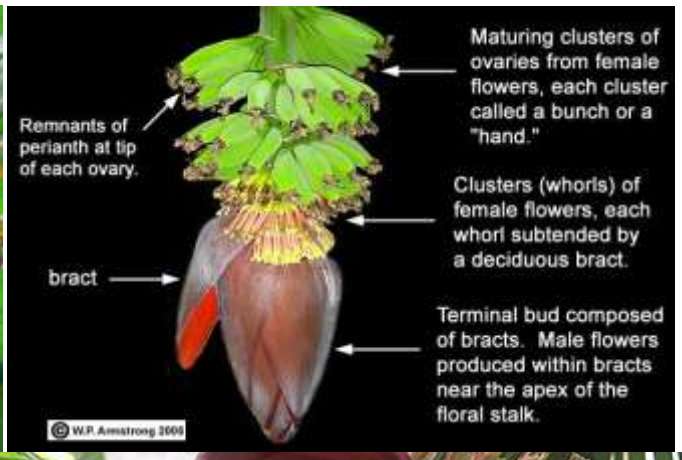


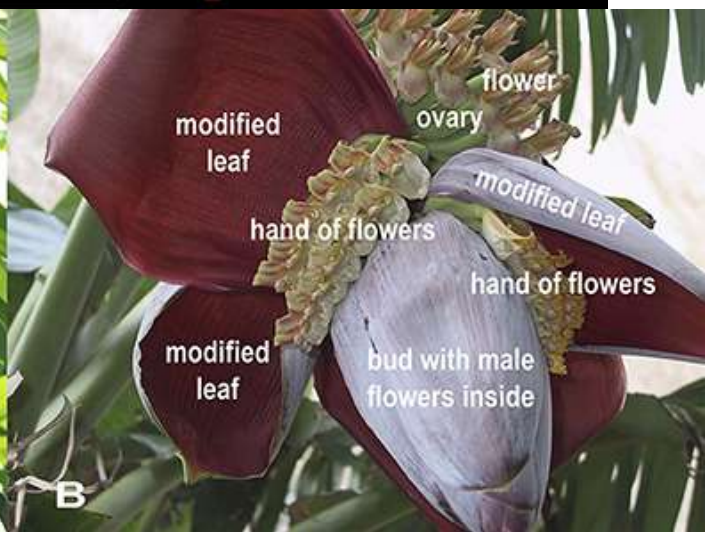
A sucker is a lateral shoot that develops from the rhizome and usually emerges close to the parent plant. Other names for sucker are keiki (in Hawaii) and pup. A sucker that has just emerged through the soil surface is called a peeper. A full grown sucker bearing foliage leaves is called a maiden sucker.
Morphologically, there are two types of sucker: sword suckers (see the photo), characterized by narrow leaves and a large rhizome, and water suckers (left on the photo), which have broad leaves and a small rhizome. Water suckers have a weak connection to the parent plant and as such will not develop into a strong plant. The number of suckers produced varies with the type of cultivar. The sucker selected to replace the parent plant after fruiting is called the follower or ratoon.

- ***Inflorescence: -***

The inflorescence is a complex structure that includes the flowers that will develop into fruits. The botanical term for the banana inflorescence is a thyrse (an inflorescence in which the main axis continues to grow and the lateral branches have determinate growth. The main types of flowers are the female flowers and the male flowers. Female flowers develop into fruits;

- ***Female flower: -***

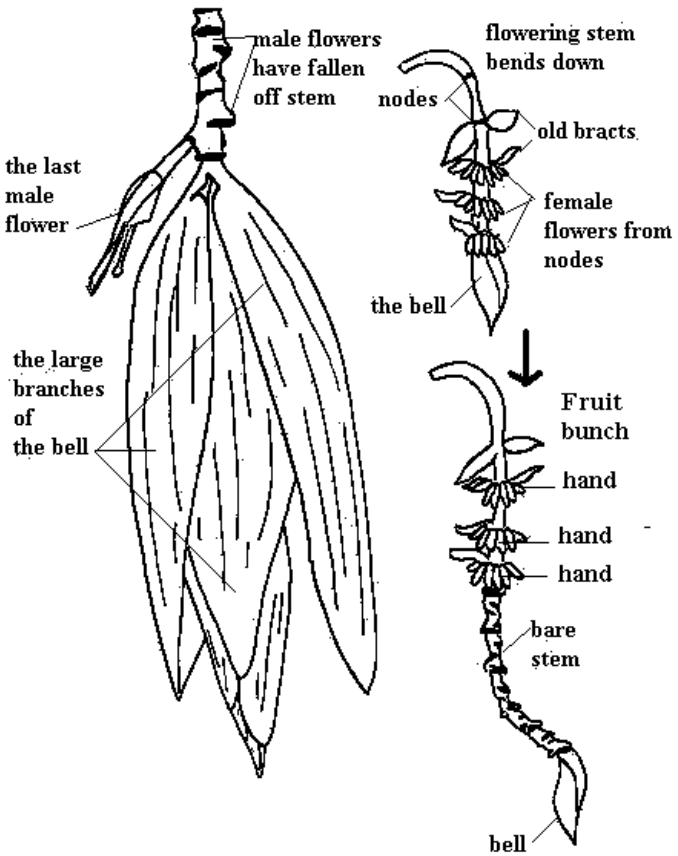


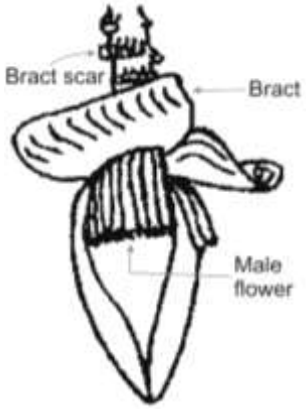


The female ***(***pistillate***)*** flowers appear first. In cultivated bananas, the ovary develops into a seedless fruit by parthenocarpy (without being pollinated). As it lifts, the bract (a modified leaf associated with a reproductive structure) exposes a cluster of female flowers that are normally arranged in two rows. These flowers will develop into a hand of fruit. The number of hands in the bunch depends on the number of female clusters in the inflorescence, and varies depending on the genotype and environmental conditions.

- ***Male flower: -***

51.7.1 Banana inflorescence, "flower"





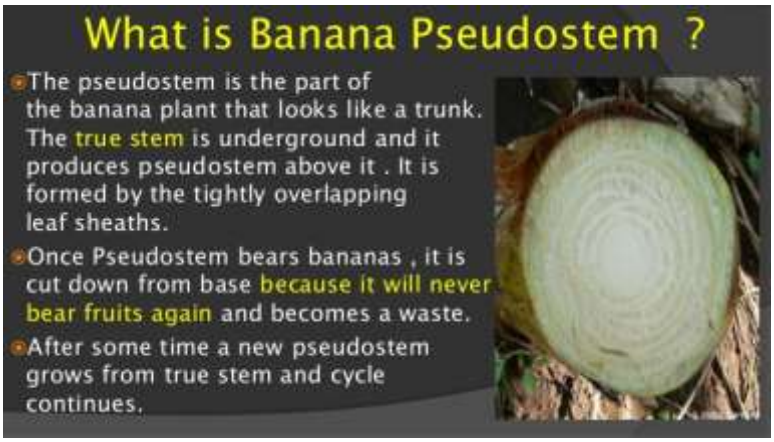
As the female flowers develop into fruit, the distal portion of the inflorescence elongates and produces clusters of male (staminate) flowers that produce pollen. In cultivated bananas, the amount of pollen is reduced or may be absent.

- ***Stem: -***

Banana plants stripped of their leaves to reveal the stem.

The stem provides support to the leaves, flowers and fruits. The leaves & flowers are attached to a node, and the sections between nodes are internodes. The stem develops from the apical meristem on the rhizome and grows inside the pseudostem until it emerges at the top of the plant. The part inside the pseudostem is called the aerial stem. When it emerges at the top of the plant, it becomes the peduncle. The leaves are attached to the aerial stem (erroneously called floral stem whereas the flowers and fruits are attached to the peduncle).

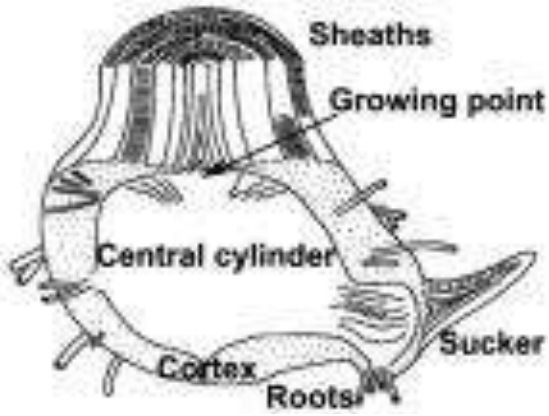
- ***Pseudostem: -***

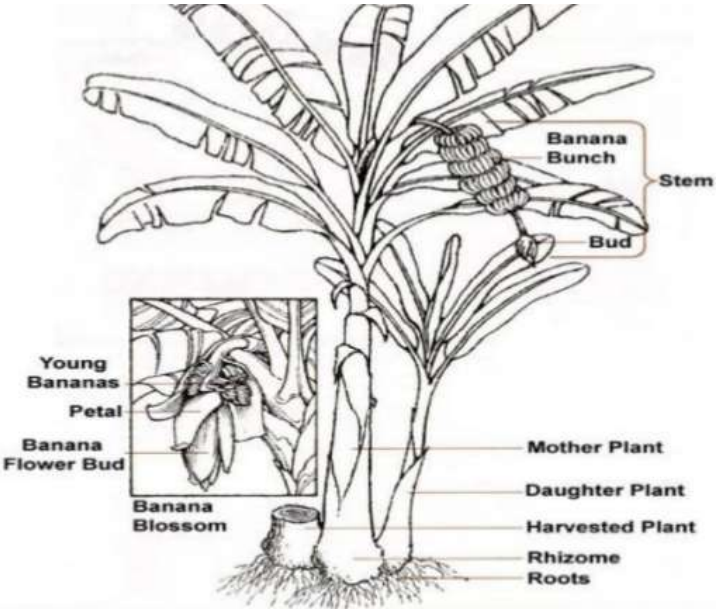


The stem is visible in the center of the pseudostem

The pseudostem is the part of the plant that looks like a trunk. This 'false stem' is formed by the tightly packed overlapping leaf sheaths. The pseudostem continues to grow in height as the leaves emerge one after the other and reaches its maximum height when the stem, which has been developing inside the pseudostem, emerges at the top of the plant. Even though the pseudostem is very fleshy and consists mostly of water, it is quite sturdy and can support a bunch that weighs 50 kg or more.

- ***Rhizome: -***





The rhizome is commonly referred to as a corm, and occasionally as a bulb, but the botanically correct term is rhizome. Rhizomes are characterized by horizontal underground growth; production of roots from multiple nodes; and production of clonal plants. Corms, on the other hand, are vertical enlarged compact stems with a tunic of thin leaves and roots arising from a single node; features that do not describe well the banana plant's underground structure.

- ***Root system: -***

The root system is by which the plant takes up water and nutrients from the soil. The roots are produced by the underground structure called a rhizome**.** The primary roots originate from the surface of the central cylinder, whereas secondary and tertiary roots originate from the primary roots.

- ***Peduncle***

In botany, the peduncle is the stalk that supports the inflorescence. Yet, in the Descriptors for bananas, the peduncle refers only to the stalk between the leaf crown and the first hand of fruit, whereas the stalk that actually supports the female and male flowers is called rachis; the peduncle extends to the meristem in the male bud and is composed of three sections: the transitional, female and male peduncles.

Transitional peduncle: -

The transitional peduncle supports organs that are in transition from leaves to bracts: sterile nodes with a bract that abscises at bunch emergence. It corresponds that what is traditionally called the peduncle.

Female peduncle: -

The ***female peduncle*** supports the female flowers that develop into fruits.

Bunch: -

The bunch is the descriptive term that includes all the fruits. The fruits are arranged into hands, the former clusters of flowers that were each subtended by a bract. By analogy, the fruits in a hand are often called fingers.

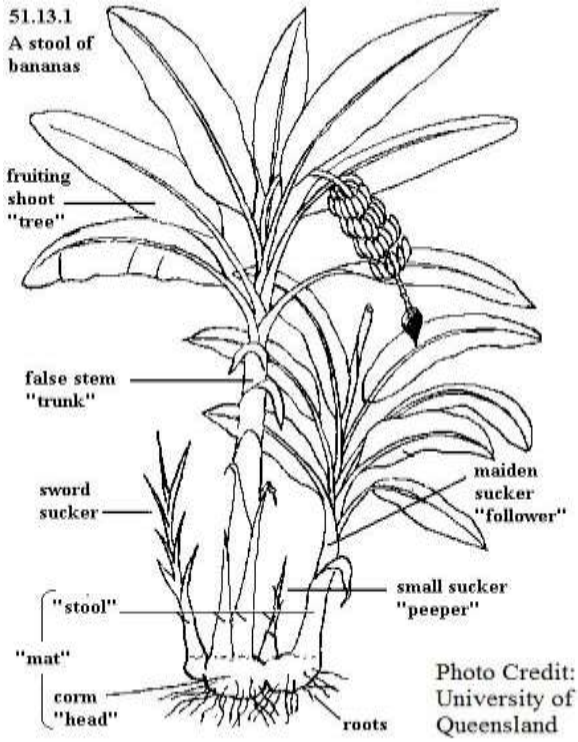
Male peduncle*: -*

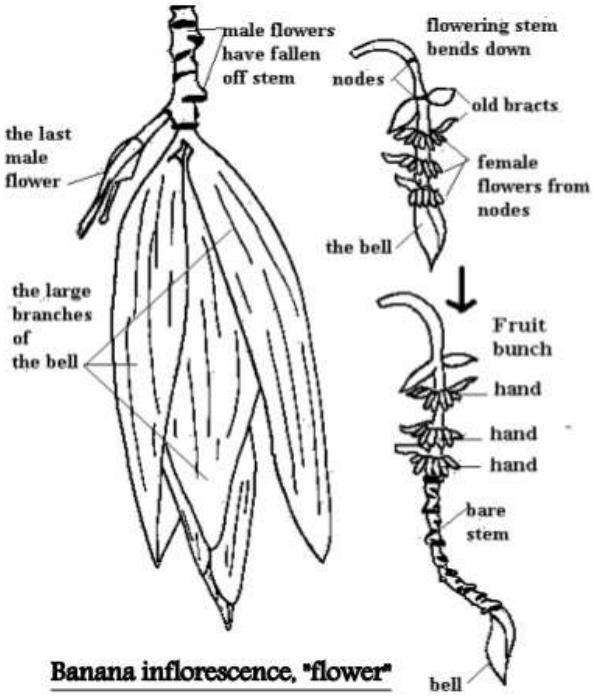
The male peduncle supports the male flowers in the male bud. It corresponds that what is traditionally called the rachis, an ambiguous term that in botany has been used in relation to both vegetative and reproductive parts, whereas the term peduncle is only used for stems that support flowers.

The part above the male bud can be bare or covered with persistent bracts. The scars (nodes**)** indicate where the bracts were attached. The male peduncle continues to grow as the fruits are maturing.

Male bud: -

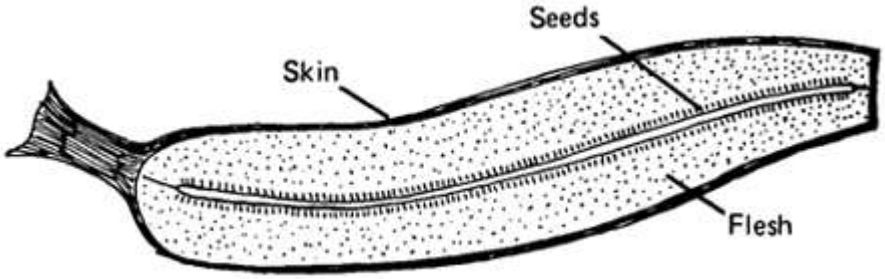
The male bud contains clusters of male flowers. Each cluster is subtended by a bract. The male bud is sometimes called the bell. In some cultivars, it ceases to grow after the fruits have set and can be more or less exhausted by the time the bunch reaches maturity. The presence or absence of the male bud is one of the traits used to distinguish cultivars.





Banana inflorescence, "flower"

- ***<u>Banana fruit: -</u>***



A banana is an elongated, edible fruit (called as beery in botany); the fruit is variable in size, color, and firmness, but is usually elongated and curved, with soft flesh rich in starch covered with a rind, which may be green, yellow, red, purple, or brown when ripe; it is eaten in all part of the world all season; it is cheap & full of health benefits; there are many types of banana; there are about 110 different species of banana; the fruits grow in rows called tiers or hands; there can be as many as twenty fruits to a hand, and as many as twenty tiers in a bunch. A bunch usually weighs between 30 and 50 kilograms; a single banana weighs about 125 grams in which mostly water is present; banana peel is the outer skin of a banana. It is usually peeled to get at the delicious insides; the peel is eaten by goats, cows, buffalo etc; monkeys also like banana very much.

- ***Types of banana: -***

1. Cavendish Banana: -

The Cavendish banana is your "typical" banana found at the local grocery store or farmer's market. They are slightly sweet and have a creamy texture. They have various stages of ripening, from green to yellow, to yellow with brown spots.

2. **Pisang Raja: -**

Pisang Raja bananas are popular in Indonesia. Featuring a yellow to orange color, they taste like honey-flavored custard with a smooth and creamy consistency. They're slightly smaller than Cavendish Bananas, averaging four to six inches in length.

3. **Red Banana: -**

As their name suggests, red bananas have a reddish-purple skin. They have light pink colored flesh and are much sweeter and softer than Cavendish bananas. They also have a slight raspberry flavor that makes them absolutely irresistible.

4. **Lady Finger Banana: -**

Lady Finger bananas, also known as baby bananas, are sweeter and smaller than Cavendish bananas. They're usually around three inches in length and feature a creamy texture and sweet flavor with notes of honey.

5. **Blue Java Banana: -**

Blue Java bananas are also known as the ice cream banana due to their sweet vanilla flavor and extreme creaminess. They feature a beautiful blue peel and a white flesh. They're actually pretty hardy and can grow in colder regions.

6. **Plantain Banana: -**

Plantains are a subgroup of bananas that are referred to as cooking bananas. They have high starch content and are typically used in savory dishes. They aren't typically consumed raw. They're a food staple in West and Central Africa, the Caribbean islands, and Central America.

7. **Manzano Banana: -**

The Manzano Banana is sweeter than Cadvendish bananas with a hint of crunchy apple-strawberry flavor. They're grown in Central and South America, the Caribbean, and Mexico. They're short and chubby with think yellow skins that turn black when fully ripe.

8. **Burro Banana: -**

Burro bananas have a lemony and tangy taste, which makes them one of the most unique types of bananas. They have a flatter, smaller and squarer shape than Cavendish bananas. The flesh is creamy white or yellow and is soft with some firmness in the center.

9. **Barangan Banana: -**

Yellow with small black dots, the Barangan banana has a sweet, mild taste. The flesh is white. It's a popular variety and is eaten as a dessert in many regions across the tropics.

10. **Goldfinger Banana: -**

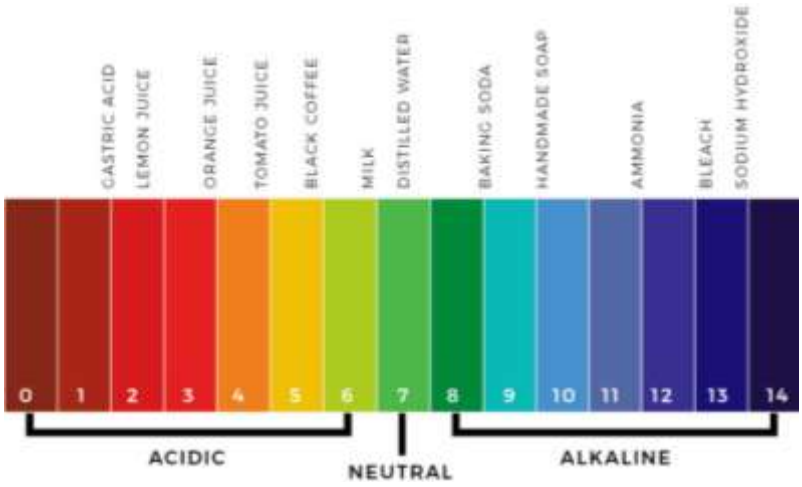
The Goldfinger banana was first grown in Honduras by a team of scientists as a pest-resistant banana. It can be cooked when green and eaten raw once fully ripe. It's similar to the Cavendish banana, with its eventual aim to replace the more susceptible-to-disease variety.

- ***pH of banana is: -*** 4.5 to 4.7; it is acidic because its pH is below 7. It is rich in protein & carbs.

pH is a measure of hydrogen ion concentration, a measure of the acidity or alkalinity of a solution. The pH scale usually ranges from 0 to 14. Aqueous solutions at 25°C with a pH less than 7 are acidic, while those with a pH greater than 7 are basic or alkaline & 7 is neutral; only aqueous solutions have pH levels, vegetable oil has no pH value. Likewise, other oils such as animal and petrochemical oils also have no pH value. Fatty acids are organic molecules often found in foods, including vegetable oils.

The pH of pure water is 7. In general, water with a pH lower than 7 is considered acidic, and with a pH greater than 7 is considered alkaline. The normal range for pH in surface water systems is 6.5 to 8.5, and the pH range for groundwater systems is between 6 and 8.5. We can add normal water to reduce the acidity.

It is Sunnat of Prophet Muhammed (s.a.w) to mixe acidic with Alkaline to make it neutral or less acidic that why He use eat dates with watermelon or cucumber or dry dates with little butter; so you can mix one acidic with alkaline; also it is Sunnat to drink honey mixed in water; also dates or raisins soaked in water over night & drink the syrup (sharbat). Remember do not soak dates & raisin together at one time; soak at separate time & drink.



- ***Calories of banana: -***

100 grams of banana gives 89 calories. 100 grams of it has Water: 75%, Protein: 1.1 grams, **Carbs: 22.8** grams, **Sugar: 12.2 grams**, Fiber: 2.6 grams, Fat: 0.3 grams so for this reason it is high in calories & acidic.

- ***Glycemic index & Glycemic load: -***

Glycemic index (GI) of banana is 55 & glycemic load is 13; it is mid-range GI: moderate GL so diabetic patients should not eat much banana

A food is considered to have a low Glycemic index (GI) if it is 55 or less; mid-range GI if 56 to 69 & high GI if 70 or more. *Glycemic index* is a number. It gives you an idea about how fast your body converts the carbs in a food into glucose.

A low Glycemic load (GL) is between 1 and 10; a moderate GL is 11 to 19; and a high GL is 20 or higher. For those with diabetes, you want your diet to have GL values as low as possible.

The *glycemic load* (GL) of food is a number that estimates how much the food will raise a person's blood glucose level after eating it. *Glycemic load* accounts for how much carbohydrate is in the food and how much each gram of carbohydrate in the food raises blood glucose levels.

- ***Gross health benefits of banana: -***

It is easy to digest; it increases digestion, helps in scurvy diseases, flu, bronchitis, exhaustion, weakness & increases weight, reduces Blood pressure, Helps kidney function and protects atherosclerosis (hardening of arteries), teeth problems, Good in diarrhea, liver diseases, gastric ulcers, celiac diseases, It is helpful in Sprue diseases, Prevents acidity, acidosis, and fermentation in stomach, Maintain pH of stomach, blood and body, Increases urine out-put, Protects stomach linings and layer, Good for pregnancy and all stomach diseases, Increases sperm counts, libido, youthfulness, It is anti-ageing because it has melatonin, Gives energy, helps brain growth, protects from all types of ulcers, Good for athletes, exercising people, sports persons, Good for children, old and young age people, A good source of pre & post workout (exercise) food, Good in taste, can be eaten or cooked in food, can eaten all season.

- ***Clinical pharmacology of banana: -***

Ripe & unripe forms of banana have been shown to possess antiulcer, antioxidant & radical scavenging activities; banana has been utilized as a vector for many vaccines due to increased bioavailability & easy administration; pectin present in banana are widely used in pharmaceutical company for making tablets; banana flower contains tannin, sterol, saponin, triterpenes etc which has lot of health benefits.

Banana peel is generally discarded as a waste; however, it is a very rich source of important phyto-constituents. The peel contains 6–9% dry matter of protein and 20–30% fiber. Usually the ripe banana peels contain 30% free sugar and 15% more starch than green banana peels. Moreover, banana peel is a good source of lignin, cellulose, and hemicellulose with variety of active functional groups (carboxyl, hydroxyl, and amine). The peel also has phenols, carbohydrates, terpenoid, and saponins.

The flowers of banana was established as (24R)-4α-14α, 24-trimethyl-5-cholesta-8, 25 (27)-dien-3β-oil [12]. Banana bracts were also investigated as a potential source of natural colorants. Monomeric anthocyanin content was found to be 32.30 mg/100 g. Other anthocyanins include 3-rutinoside derivatives of delphinidin, pelargonidin, peonidin, and malvidin.

Banana pulp contains antioxidants, including, vitamins, carotenoids, and phenolic compounds such as catechin, epicatechin, lignin, tannins, flavonoids as well as anthocyanins. Serotonin, norepinephrine, tryptophan, indole compounds, starch, iron, crystallizable and non-crystallizable sugars, vitamin C, B-vitamins, fats, and mineral salts have been noted in the fruit pulp of Musa paradisiaca var. sapientum. Cellulose, hemicelluloses, and amino acids like arginine, aspartic acid, glutamic acid, leucine, valine, phenylalanine, and threonine have been isolated from the pulp and peel of Musa paradisiaca. Acyl steryl glycosides like sitoindoside-I, II, III, and IV as well as steryl glycosides such as sitosterol gentiobioside, sitosterol myo-inositol-β-D-glucoside were isolated from the fruit of Musa paradisiaca. Banana peel is generally discarded as a waste; however, it is a very rich source of important phyto-constituents. The peel contains 6–9% dry matter of protein and 20–30% fiber. Usually the ripe banana peels contain 30% free sugar and 15% more starch than green banana peels. Moreover, banana peel is a good source of lignin, cellulose, and hemicellulose with variety of active functional groups (carboxyl, hydroxyl, and amine). Phytochemical analysis of Musa paradisiaca and Musa acuminata peels revealed the presence of phenols, carbohydrates, terpenoid, and saponins. The presence of such potent phyto-constituents in banana makes it a great target for nutritional and therapeutic researches. There are lots of benefits of banana mentioned in separate contents of it below.

- ***Modern uses of it: -***
- ***Quantity & time to eat banana & its uses: -***

One or two banana is enough a day for adults and for children up to 6 yrs half banana. Eat early morning, empty stomach or with breakfast. Those who do exercise can have more, 2 banana pre & 2 banana post workout. It can be taken with milk. Those who have cough & cold can take it with black pepper, turmeric or honey. Do not eat unripe banana because it has lot of starch. Eat the ripe banana because it is rich in protein, vitamin, calcium etc. Do not eat at night. Do not eat with cold stuff. Do not drink water after eating banana. Do not eat in diabetes & obesity. Raw is used in cooking purpose; making chips etc. Chew it properly. It is used in making jellies, Slices of raw banana are dried & flour is made out of it & used. Breads can be made with its flour. Banana is best while travelling and journeys.

- ***Active ingredient of banana: -***

Its minerals, vitamin c, melatonin, fiber, sugar etc.

- ***Contents/constituents of banana: -***

All contents may not present in all types of it, because there are many varieties of it according to geographical regions & content may differ a lot as per cultivation, soil, seed, climate etc.

A good quality of banana contains little amount of amino acids mentioned in table below: -

The above ingredients are based on scientific study, means these has been indentified, known & learnt by modern science, it does not means that it contains only these ingredients, there may be many more ingredients which are yet to be discovered, learnt & known by modern science.

The details given below are based on natural ingredients found in banana.

Water 75%, starch 5%, sugar 12% (glucose, fructose, sucrose, maltose, fiber 3%, palmitic acid, linolenic acid, oleic acid, palmitoleic acid, stearic acid, lauric acid, myristic acid, capric acid, oxalic acid, Vitamin K,E, C, B1, B2, B6, calcium, iron, potassium, little sodium, magnesium, phosphorus, carbohydrate 23%, citric acid, malic acid, carotenoid. catechin, epicatechin, lignin, tannin, anthocyanin, apigenin glycosides, myricetin-3-O-rutinoside, kaempferol, dopamine, and serotonin, proteins (amino acid) as well as flavonoids, fatty acids, steryl esters, and sterols, besides oleic and linoleic acids and pectin etc.

Banana	150 grams
Amino acids in mg.	150
Tryptophan(mg) (% RDI)	14 (5%)

Threonine(mg) (% RDI)	42 (4%)
Isoleucine(mg) (% RDI)	42 (3%)
Leucine(mg) (% RDI)	102 (4%)
Lysine(mg) (% RDI)	75 (4%)
Methionine(mg) (% RDI)	12 (2%)
Cystine(mg) (% RDI)	14 (5%)
Phenylalanine(mg) (% RDI)	74 (8%)
Tyrosine(mg) (% RDI)	14 (2%)
Valine(mg) (% RDI)	71 (4%)
Histidine(mg) (% RDI)	116 (17%)
Arginine(mg)	74
Alanine(mg)	60
Aspartic acid(mg)	186
Glutamic acid(mg)	228
Glycine(mg)	57
Proline(mg)	42
Serine(mg)	60

- ***Each contents of banana explained separately: -***
- ***Linolenic acid (ALA): -***

It is an omega 3 fatty acid, it essential fatty acid necessary for health & cannot be produced in human body, it is also called as ALA (alpha linolenic acid). It is the substrate for the synthesis of longer-chain, more unsaturated fatty acids eicosapentaenoic acid (EPA) & docosahexaenoic acid (DHA) required for tissue function.

Main sources of linolenic acid (ALA): -

Flax seed oil, rape seed oil, soybean, pea leaves, fish oil, evening primrose oil, vegetable oil, walnut, meat, grape seed oil.

Basic pharmacokinetic of ALA (based on human intake in natural food products): -

Same as omega 6

Basic clinical pharmacology of ALA: -

It is useful to prevent heart disease, control blood pressure, control cholesterol, prevents & reverse atherosclerosis, it is anti inflammatory, anti obesity, anti cancer, reduces fibroadenoma, breast lumps, good & helpful for skin, nail, hair, brain, organs.

- ***Oleic acid: -***

Its short hand notation is C18:1, it is a non essential (means it is produce naturally in the body) monounsaturated omega 9 fatty acid, it makes up 55% to 85% or more of extra virgin olive oil, It is insoluble in water & soluble in alcohol. It increases absorption of many drugs through skin by disrupting the lipids under the skin and penetration of the drugs, so olive oil is best to be used with other applications on skin and used in cosmetic formulas. It is advised in Hadith to eat it & massage with it just notice the importance of it.

Main sources of oleic acid: -

It is present in extra virgin olive oil is the best, also present in avocado oil, camellia oil, shea nut oil, apricot oil, sweet almond oil, whole egg, nuts, argan oil etc.

Basic pharmacokinetics of oleic acid (based on human intake in natural food products): -

It is believed that it is absorbed by different tissues mediated via passive diffusion to facilitate diffusion (this is under research) after taken up by the tissues it is stored in the form of natural triglycerides or oxidized, it is transported by lymphatic system; it is also believed to penetrate through skin (it is under research), its excretion is

in stool. It is stored 98% in adipose tissues depots in form of triglycerides. Its metabolism & plasma half life is yet not known.

Basic clinical pharmacology of oleic acid: -

It increases bioavailability of following medicines cortisol, hydrocortisone, betamethasone, 17 benzoate betamethasone, 17 valerate (betamethasone), ketarolac (anti inflammatory), metronidazole, progesterone & estradiol. So I advised to mixed powder of prednisolone mixed in extra virgin olive oil and apply on eczema & psoriasis and get good results in cheaper rates.

Oleic acid prevents cardio vascular disease, blood pressure, skin disease, breast cancer, colon cancer, prostate cancer, stomach cancer, diabetes, gall stones, gastrointestinal disease and pancreatic disease. It reduces cholesterol, triglycerides, LDL, inflammation, swelling etc.

- ***Palmitoleic acid: -***

It is an omega 6 monounsaturated fatty acid; it is present in all tissues of human body & also in adipose tissues & in liver in high concentration.

Main sources of palmitoleic acid: -

It is mainly present in pumpkin seed oil, breast milk, vegetable oil, marine oil, macadamia oil, salmon oil.

Basic pharmacokinetics of palmitoleic acid (based on human intake in natural food products): -

Its absorption, metabolism & excretion are under research.

Basic clinical pharmacology of palmitoleic acid: -

It is anti thrombotic thus helpful in stroke, it is anti inflammatory, reduces cholesterol & other lipids, high blood glucose, prevents cardio vascular disease, obesity and improves insulin sensitivity.

- ***Stearic acid: -***

It makes up 0.5% to 5 % of extra virgin olive oil; it is saturated fatty acid.

Main sources of stearic acid: -

It is mainly present in olive oil, also present in butter, whole milk, yeast bread, egg & etc.

Basic pharmacokinetics of stearic acid (based on human intake in natural food products): -

Its absorption, metabolism & excretion are under research.

Basic clinical pharmacology of stearic acid: -

It cleans the skin & removes dirt, sweat & excessive sebum from skin & hair. The colour of olive oil is due to pigments of stearic acid like chlorophyll, pheophytin & carotenoid that's why extra virgin olive oil has colour of its own which refined & pomace do not have.

- ***Palmitic acid: -***

It makes up 7% to 13% of extra virgin olive oil; it is a common saturated fatty acid; it is the first fatty acid produced during lipogenesis (fatty acid synthesis) & from which longer fatty acids can be produced.

Main sources of palmitic acid: -

It is present in olive oil, flaxseed oil, soyabean oil, sunflower oil, palm oil, cocoa butter, meat, milk & etc.

Basic pharmacokinetics of palmitic acid (based on human intake in natural food products): -

Its absorption, metabolism & excretion are under research.

Basic clinical pharmacology of palmitic acid: -

It softens the skin & keeps it moist thus good for psoriasis & eczema. It coats the skin, it is powerful anti-oxidant; it maintains the health of hair & skin from aging, cleans them from dirt, sweat, excessive sebum (main cause of acne and boil on face & other parts of the body).

- ***Natural oxalate (oxalic acid): -***

It is present in many types of plant, it is an organic compound found in leafy vegetables, fruits, nuts, seeds etc. In plants it usually bounds to minerals forming oxalate. The term oxalic acid & oxalate are used interchangeable in nutritional science.

Main sources of natural oxalate: -

It is present in beetroot leaves (chard leaves), beetroot, carrot, spinach, sweet potato, turnip leaves, potato, apple, strawberry, green beans, broccoli, apricots, fig etc.

Basic pharmacokinetics of oxalate (bases on human intake in natural food products): -

In the human body some of the eaten oxalate is broken down by bacteria before it combines (mainly) with calcium & iron in colon & in kidneys (also in urinary tract) to form crystals & is excreted in urine as minute crystals (little is excreted in stool also) if taken in large quantity can cause kidney stones.

Also when fat is not absorbed properly, the fats binds with calcium and leaves oxalate behind, this oxalate is taken up by kidneys to excrete it; it also prevents absorption of calcium & other minerals; Presence of prebiotic can effect oxalic acid excretion. Our body makes oxalates as an end product of protein, vitamin c etc metabolism. It is excreted in urine & stool. Oxalate present in food is soluble & insoluble, insoluble bind with calcium or other molecules that makes it much harder to absorb; soluble do not bind with other molecules & is easily absorbed. Absorption of it differs among people, for some, oxalate is largely broken down in the intestines & eliminate without causing issues; in some, large amount of oxalate is absorbed; & in some, leaky gut can increase the absorption of it & the needle shaped oxalate crystals can perforate the mucus membrane damaging the cells of intestine & cause more leakiness.

Leaky gut is also called as increased intestinal permeability, it is a condition in which many things can pass through the intestinal wall, and this occurs due to breach in intestinal wall or damaged cells, things can pass through their gasps (breach).

Excessive oxalate accumulates in crystal form in many parts of the body like joints, muscles, kidneys etc.

Basic clinical pharmacology of oxalate: -

It reduces absorption of some minerals because it binds with some mineral in the intestine, if taken in larger amount causes kidney stones, autism, vaginal pain etc; we should drink lot of water to avoid excessive oxalate collection in the body & to flush out; its benefits in human body is under research.

- ***Myristic acid: -***

It is a common non toxic long-chain saturated fatty acid; it is also called as tetradecanoic acid; it is water soluble; its salt & esters are commonly referred as myristates.

Main sources of myristic acid: -

It is mainly present in pumpkin seed oil, butter fat, palm kernel oil, coconut water & oil, nutmeg oil etc.

Basic pharmacokinetics of myristic acid (based on human intake in natural food products): -

Its absorption, metabolism & excretion are under research.

Basic clinical pharmacology of myristic acid: -

It cleans the skin & keeps the skin hydrate, plump & youthful; it is used in beauty products, shaving, soaps, creams, lotions, hair conditioner & personal care products manufacturing.

- ***Malic acid: -***

It is a natural organic substance present in many fruits & plants; it is an alpha-hydroxyl acid (a natural acid) commonly used in skin care products & has many health benefits.

Main sources of malic acid: -

It is present in watermelon, quince, apricot, banana, grapes, quince, kiwi, orange, straw berries, mango, luchees, apple, pear, cherries, quince etc.

Basic pharmacokinetics of malic acid (based on human intake in natural food products): -

Its absorption, metabolism & excretion are not known yet & are under research.

Basic clinical pharmacology of malic acid: -

It is anti aging, removes dead skin cells, treats acne, promotes skin hydration, improves complexion, boost sports performance, promotes energy production, increases exercise capacity, removes muscles fatigue, reduces muscular pain & muscle weakness, increases mineral absorption thus anti arthritis, increases digestion, chelator of aluminum, it is also a body detox.

Malic acid has low pH & can aid in stomach digestion when the body does not produces naturally hydrochloric acid for digestion; it acts on quick absorption, helps the whole digestive system, softens the gall stones, dilates the bile duct & act on excretion of gall stones.

- ***Epicatechin: -***

It is a type of flavanol (a natural type of phenol) (please note flavanol & flavonols are different), flavonols is class flavonoids (phenol) that contains a ketone group & flavanol is a natural phenol.

Main sources of epicatechin: -

It is present in apple, quince, dark chocolate, cherries, guava, pear, black berry, green tea, cocoa etc.

Basic pharmacokinetics of epicatechin (based on human intake in natural food products): -

Its absorption, metabolism & excretion are not yet known & are in research.

Basic clinical pharmacology of epicatechin: -

It is anti oxidant, reduces myostatin (myostatin is inhibitor of muscles growth).

- ***Catechin: -***

It is a natural polyphenol; it is a plant secondary metabolite.

Main sources of catechin: -

It is mainly present in tea, cocoa, berries, apples, grapes seeds, kiwi, strawberries, green tea etc.

Basic clinical pharmacology of catechin: -

It is antioxidant, prevents cell damage, anti-inflammatory, anti-cancer, promotes heart & brain health and reduces blood pressure & weight.

- ***Carotenoid: -***

It is a fat soluble; it is also called as tetraterpenoid; it is an organic pigment produced in plants giving them bright red, yellow, orange etc colour. It helps the plant to absorb light energy for photosynthesis; it protects our body from diseases & maintains health. It is of more than 600 types of which 50 to 60 types are eaten in food by human. It is not made by our body we depend on food source to be eaten.

Main sources of carotenoid: -

Carotenoid is present in olive oil, watermelon, tomato, kale, oranges, olive, carrot, plums, apricots, mango, sweet potato, kale, spinach, coriander, grapes etc.

Basic pharmacokinetics of carotenoid (based on human intake in natural food products): -

It is fat-soluble; It first gets emulsified followed by solubilized in micellar then require bile salts & absorbed in intestine, little is absorbed in stomach; it is excreted in stools (research in on), it is stored in body fats and will convert the stored carotenoid into vitamin A when needed by the body and use it.

Basic clinical pharmacology of carotenoids: -

It is converted into vitamin A in our body, it is essential for vision, immune system, prevents cardio vascular disease, it helps reducing inflammation, cancers risk.

- ***Lignin: -***

Lignin is a class of complex organic polymers that form key structural materials in the support tissues of vascular plants and some algae. Lignins are particularly important in the formation of cell walls, especially in wood and bark, because they lend rigidity and do not rot easily.

- ***Tannin: -***

It is of astringent (dry & puckery feeling in mouth) taste, it is a polyphenol present in many plants, fruits, plant's wood, bark, leaves, skin, seeds etc. It is also called as Tannic acid; it is of 2 types hydrolysable & condensed. Hydrolysable is decomposable in water & reacts with water & form other substance. Condensed form is insoluble & precipitates, it is called as tanner's reds. But most of tannic acid is water soluble.

Main sources of tannin: -

It is present berries, apple, barley, nut, tea, legumes, grapes, pomegranate, quince, oak wood, lemons, squash etc.

Basic pharmacokinetics of tannin (based on human intake in natural food products): -

Its absorption, metabolism & excretion are yet not known & are under research. After ingestion its bioavailability is poor due to its large size, high affinity to bound to plasma protein & low lipid solubility. It gets hydrolyzed in glucose & release gallic acid & other compounds upon decomposition.

Basic clinical pharmacology of tannin: -

It is used internally & externally. Externally it cures & heals the condition when applied on cold sores, fever blisters, diaper rashes, bleeding gums, tonsillitis, skin rashes, white discharge, yellow discharge, minor burn etc. It is used as douche for virginal disorders like white or yellow discharge.

In food it is used as flavoring agent & naturally present in fruits etc, it relieves & cures chronic diarrhea, dysentery, hematuria (blood in urine), pain in joints, persist cold, cancers etc, it reduces high blood pressure, high lipids in blood. It is anti aging, anti oxidant, anti bacterial, anti enzymatic. It is used in medicated ointments for piles.

If used excessive it can give toxic effects on skin & internally may reduce absorption of vitamin, cause stomach irritation, nausea, vomiting, liver damage, kidney damage. It should not be used in pregnancy, breast feeding & constipation.

- ***Anthocyanin: -***

It is a type of flavonoid & is the pigments that give red, purple & blue plants their rich colouring.

Main sources of anthocyanin: -

Black soybean, pomegranate, black berries, cherries, grape, plums etc.

Basic pharmacokinetics of anthocyanin: -

Its absorption, metabolism & excretion are not known yet and are under research.

Basic clinical pharmacology of anthocyanin: -

It is a strong anti oxidant, anti cancer, anti inflammatory, removes free radicals from the body, prevents heart diseases, blood pressure, infections, urinary infections, cough & cold.

- ***Apigenin: -***

It is a natural flavonoid compound found in many fruits & vegetables serves multiple physiological functions.

Main sources of apigenin: -

It is present in onion, oranges, wheat, tea, grapes, parsley, thyme.

Basic pharmacokinetics of apigenin (based on human intake in natural food products): -

Its absorption, metabolism & excretion are yet not known & are under research.

Basic clinical pharmacology of apigenin: -

It calms the nerves, provides antioxidant effects, prevents & helps the body to fight cancer; it is anti-obesity; neuro-protective, help mood & brain function; reduces cortisol, blood sugar; improves bone, heart & skin health; promotes sleep. It is also anti bacterial, anti viral; reduces blood pressure.

- ***Myricetin: -***

It is among polyphenolic flavonoid. It is anticancer, anti oxidant, anti bacterial, anti inflammatory; reduces weight, cholesterol, L.D.L & triglycerides.

Main sources of myricetin: -

Nuts, berries, grapes, tea, walnut, onion, herbs etc.

- ***Kaempferol: -***

It is a natural flavonol (a type of flavonoid) it is tetra-hydroxy-flavone.

Main sources of kaempferol: -

Fenugreek seeds, green tea, grapes, tomato, broccoli, spinach, raspberries, peaches, green beans, onion, potato etc.

Basic pharmacokinetics of kaempferol (based on human intake in natural food products): -

It is ingested as a glycoside, absorbed in small intestines usually by passive diffusion; it is metabolized in various parts of the body. In small intestine it is metabolized to glucuronide & sulfo-conjugate by intestinal enzymes & it is also metabolized by colon micro-flora (bacteria) which can hydrolyze the glycosides to aglycones or form simple phenolic compounds. It is mainly metabolized in liver to glucurono-conjugated & sulfo-conjugated form. It is mainly excreted in urine.

Basic clinical pharmacology of kaempferol: -

It is anti oxidant, anti inflammatory, anti microbial, anti cancer, cardio protective, neuro microbial, anti diabetes, estrogenic, analgesic, anxiolytic, anti allergic, anti viral etc.

- ***Isorhamnetin-3-O-rutinoside***

It is a disaccharide derivative, a glycosyloxyflavone, a monomethoxyflavone and a trihydroxyflavone. It is a member of the class of compounds known as flavonoid-3-o-glycosides. Flavonoid-3-o-glycosides are phenolic compounds containing a flavonoid moiety which is O-glycosidically linked to carbohydrate moiety at the C3-position. Isorhamnetin 3-rutinoside is slightly soluble (in water) and a very weakly acidic compound (based on its pKa). Isorhamnetin 3-rutinoside can be found in common bean, ginkgo nuts, sea-buckthornberry, and swede, which makes isorhamnetin 3-rutinoside a potential biomarker for the consumption of these food products.

- ***Glycosides: -***

Glycosides are organic compound present in plants & animal sources in which sugar group bounded to its carbon are bounded to another functional molecule. When it is hydrolyzed with enzymes give one or more sugar moiety & this is called as glycone. The word glycosides refer to any sugar or group of sugar (lactose, fructose, glucose etc) (please note glucose only is called as glucoside; please see the difference gly & glu).

Main sources of glycosides: -

It is present in many plants, fruit, vegetable & herbs & is called with different name as per present in which plant (example: - glycoside present in senna herb is called as sennosides).

Basic pharmacokinetics of glycosides (based on human intake in natural food products): -

Its absorption, metabolized & excretion are not yet known & are in research.

Basic clinical pharmacology of glycosides: -

It is anti oxidant, anti cancer, anti tumour, anti inflammatory, helpful to liver function, anti viral, anti bacterial, anti fungal, helpful in heart diseases, cardiac arrhythmia, heart failure, congestive heart failure.

Dopamine: -

It regulates reward & pleasure centers in brain; it is a chemical important for memory, motor skills & etc.

- ***Carbohydrate: -***

It is a macronutrient needed by the body, the body receives 4 calories per 1 gram of it; carbohydrates includes sugar, glycogen, starch, dextrin, fibre & cellulose that contain only oxygen, carbon & hydrogen. It is classified in simple & complex; simple carbs are sugar & complex carbs are fibre & starch which take longer to digest. It is basic source of energy for our body.

Main sources of carbohydrates: -

It is present in watermelon (little), potato, sweet potato, bread, oats, butter, white rice, whole grain rice, pasta, lentils, banana, pineapple, quince, cucumber etc.

Basic pharmacokinetic of carbohydrate (based on human intake in natural food products): -

Its digestion begins in mouth; salivary glands releases saliva & salivary amylase (enzyme) which begins the process of breaking down the polysaccharides (carbohydrates) while chewing the food; now the chewed food bolus is passed in stomach through food pipe (esophagus); gastric juice like HCL, rennin etc & eaten material are churned to form chyme in the stomach; the chyme now is passed little by little down into duodenum, pancreatic amylase are released which break the polysaccharides down into disaccharide (chain of only sugars linked together); now the chyme passes to small intestine, in it enzymes called lactase, sucrase, maltase etc breakdown disaccharides into monosaccharide (single sugar) & absorbed in upper & lower intestines, through villi present in small intestine & send into liver through venous blood present into portal veins, as per bodies need it is releases in the blood stream & pancreas release insulin to use it as source of energy for the body, & extra is stored is converted into glycogen by liver & stored in liver & little is stored in muscles & tissues. Liver can reconverts glycogen in to sources of energy if body lacks for other source of energy, the undigested carbohydrates reaches the large intestine (colon) where it is partly broken down & digested by intestinal bacterias, the remains is excreted in stools.

Clinical pharmacology of carbohydrates: -

Carbohydrates are main sources of body energy, it helps brain, kidney, heart, muscles, central nervous system to function, it also regulates blood glucose, it acts on uses of protein as energy, breakdown of fatty acids & prevent ketosis. If we eat less carbohydrate it may lead to hypoglycemia, ketosis, frequent urination, fatigue, dizziness, headache, constipation, bad breath, dehydration etc.

Excessive intake of carbohydrates may lead to vascular disease, atherosclerosis (leads to narrowing of arteries, stroke, diabetes, obesity, fatty liver, blood pressure etc.

- ***Dietary fibre: -***

It is an eatable part of vegetables & fruit; our body cannot digest it just passes the small intestines & colon & excrete in stools; it is of two types 1) soluble fibre 2) insoluble fibre.

Soluble fibre dissolve in water & form a gel like material & helps in controlling blood cholesterol & blood glucose; it is found in apple, carrot, barley, oats, peas, beans watermelon etc.

Insoluble fibre do not dissolve & promotes excretion & increase bulk of the stool thus relief constipation & helps in elimination of toxins also. It is found in wheat flour, beans, cauliflower, potato, green beans, watermelon, beetroot, beet leaves etc.

This is the reason it is helpful in constipation conditions, it can eaten in pregnancy to relief constipation and get other benefits of it also.

Basic pharmacokinetics of dietary fibre (based on human intake in natural food products): -

Soluble fibres get dissolve in water & become a gelatinous substance; do not get digested; it helps to slow the digestion & help the body to absorb vital nutrient from eaten food.

Insoluble fibres do not dissolve in water but remain in fibrous form, and do not get digested; it helps the food pass through the digestive sytem and increase the bulk of stool & eliminate toxins also.

Basic clinical pharmacology of dietary fibre: -

It helps in slow down the digestive process thus gives a good control in blood glucose, improves insulin sensitivity, reduces risk of diabetes, maintains weight, helpful in obesity, reduces blood pressure, reduces cholesterol, reduces inflammation, reduces risk of heart disease, relieves constipation thus helpful in piles, fistula & other rectal disorders & disease, improves bowel movement thus improves bowel health, slowdowns the digestion thus improves quality of digestion, reduces risk of many types of cancer.

- ***Glucose: -***

It is among simple type of natural sugar present in fruits & vegetables; it is a source of energy for our body & related to many function & digestion.

- ***Sugar (fructose): -***

Sugar present in beetroot is fructose; (but diabetic patients should not eat much of it).

Main sources of fructose: -

It is present in watermelon, honey, banana, apple, mango, cherry, strawberry, orange, kiwi, pears, pomegranate, apricots, carrots, yogurt, bread, lemon, lime, green beans, beetroot etc.

Basic pharmacokinetics of fructose (based on human intake in natural fruit & food products): -

Fructose digestion begins in the small intestine (more in upper jejunum) via active transport or facilitated transport (not known properly). Our body cannot absorb intact polysaccharide molecules. Therefore, if fructose is present in the form of sucrose, sucrase, an enzyme, must first break up sucrose into separate glucose and fructose components. Single fructose molecules then enter the lining of the small intestine through a special channel and exit out the other side into the bloodstream, once in the bloodstream, fructose travels with all other absorbed nutrients to the liver for metabolism and processing.

Metabolism: -

Fructose metabolism occurs entirely in the liver. Through a complicated process called fructolysis, fructose undergoes several chemical and structural changes with the help of aldolase B (an enzyme in the liver).

Extra fructose needs to be changed into glycogen by liver & stored in liver, once the storage is full in liver then liver convert it into triglycerides & triglycerides are further converted by liver into very low-density lipoprotein (VLDL) & stored in fat cells & muscles. Excessive fructose is excreted in urine.

Basic clinical pharmacology of fructose: -

Fructose has low glycemic index & results in moderate release of insulin in the blood stream relative to glucose & sucrose; fructose gives the least dental caries among other types of sugars, fructose is more sweeter than other types of sugar; it does not raises blood sugar much as glucose does, it is used as sources of energy in the body, excessive intake of it may cause fatty liver, metabolic disorder, blood pressure, increase lipids, increase in uric acid level, increase in free radicals etc.

- ***Sucrose: -***

Sucrose is common sugar. It is a disaccharide, a molecule composed of two monosaccharides: glucose and fructose. Sucrose is produced naturally in plants, sucrose is digested quickly. A serving of food rich in sucrose can cause a sharp increase in blood sugar that is often followed by a sharp decrease. The sudden rise and fall in blood sugar often affects mood, causing sudden bouts of irritability and fatigue. But vegetables & fruits contain little amount of sucrose.

- ***Maltose: -***

Maltose is also known as maltobiose or malt sugar, it is a disaccharide; maltose is a disaccharide that is made up of two glucose units. It has a slightly sweet taste, but it's most important function is during digestion. Since most carbohydrates are in a form that cannot be absorbed, it is important for these carbohydrates to be broken into smaller pieces.

- ***Sodium: -***

Here we are learning natural sodium, its symbol is Na & atomic no. 11; it is not produced in the body we need to take it in food sources; it is an important & essential mineral on which our body functions; it regulates blood pressure, blood volume etc.

Main sources of sodium: -

Excessive intake of sodium should be avoided; cucumber has very less amount of sodium; vegetables & fruits have less sodium in them which is good for the body. It is present in beans, meat, fish, chicken, chilli, bread, rolls, milk, celery, beetroot etc.

Basic pharmacokinetic of sodium (based on human intake in natural food products): -

It is absorbed in ileum by active sodium transport because it is impermeable & in jejunum absorption takes place via mediated active transport & depends on levels of water, bicarbonate, glucose, amino acids etc; its absorption plays an important role in the absorption of chloride, amino acids, glucose & water; similar mechanism are involved in the reabsorption of it in kidneys when its level in the body falls. It is excreted mainly in urine, little in sweat & stools. It is stores in bones & dissolved in various body fluids.

Basic clinical pharmacology of sodium: -

It is amongst the essential electrolyte within the body, it remains in extracellular fluid (outside the cell) mainly, it carries electrical charges within the body, kidney maintain its normal level in the body, normal level is 135-145 milli-equivalent per liter (mEq/L), it is not produce in the body, it acts on muscles contraction, nerve cells, regulates blood pressure, blood volume; it takes part in every function of the body mostly, its low level in body is called as hyponatremia, it is found more in older aged, kidney disease, heart disease, hospitalized patient, this condition may cause brain edema, low blood pressure, fatigue, tiredness etc; its high level in the body is called as hypernatremia may cause increase in blood pressure, thirst, confusion, muscle twitching or spasm, seizures, weakness, nausea, loss of appetite, swelling in body etc.

- ***Potassium: -***

It is a mineral with symbol K & atomic number 19, it is an essential mineral which body cannot prepare; it is necessary for heart, kidney & other organs to function, its low level in body is called as hypokalemia & high level is called as hyperkalemia; it is mostly present inside the cells (intracellular); normal blood range is 3.5 to 5.0 milli equivalents per/liter (mEq/L).

Main sources of potassium: -

Potassium is naturally present in banana, orange, dates, raisin, broccoli, milk, chicken, sweet potato, pumpkin, spinach, watermelon, coconut water, white & black beans, potato, dried apricot, beetroot, pomegranate, almond, quince, cucumber etc.

Basic pharmacokinetics of potassium (bases on human intake in natural food products): -

It is absorbed in small intestines by passive diffusion; it is stored mostly inside the cell, little in liver, bones & red blood cells. 80 to 90% potassium is excreted in urine & 5 to 20% is excreted in stools, sweat.

Basic clinical pharmacology of potassium: -

It is a mineral belongs to electrolytes of the body; it conducts electrical impulses throughout the body & assists blood pressure, normal water balance, muscle contraction, nerves impulse, digestion, heart rhythm, maintain pH balance. It is not produced in our body so we need to consume it through eating; Kidneys maintain normal level of it in the body by excreting excessive amount of it in urine or reabsorb it if the amount is less in the body so that the body may reuse it. Its deficiency may cause weakness, low blood pressure, constipation, nausea, vomiting etc. Its normal amount in body keeps blood pressure normal; water balance in body normal; prevents heart disease, stroke, osteoporosis, kidney stone etc.

- ***Magnesium: -***

It is an important essential mineral; its symbol is Mg & atomic no. 12; it is a co-factor for more than 300 enzymes that regulates functions in the body. Its normal range in blood is 0.75 to 0.95 millimoles (mmol)/L.

Main sources of magnesium: -

It is present in watermelon, quince, spinach, meat, egg, nuts, dark leafy green vegetables, broccoli, pumpkin seeds, dates, chicken, fish, legumes, cucumber etc.

Basic pharmacokinetics of magnesium (based on human intake in natural food products): -

It is absorbed about 20 to 50% only; it is absorbed about 40% in distal intestine when the level of it is low via passive paracellular transport & about 5% in descending colon when the level of it is high via active transcellular transport. Vitamin D increases its absorption & also acts on its excretion in urine. It is excreted in urine & stool; it is stored in bones.

Basic clinical pharmacology of magnesium: -

It is a co-factor for more than 300 enzymes that regulates functions in the body. It act on protein synthesis, muscles & nerve function, blood glucose, control blood pressure, it is required for energy production, bone development, synthesis of DNA & RNA. It also plays a role in active transport of calcium & potassium ions, muscles contraction, normal heart rhythm etc.

- ***Phosphorus: -***

It is an essential mineral; its symbol is P & atomic no. 15, it is needed for many parts & functions of the body.

Main sources of phosphorus: -

It is present in watermelon, quince, meat, nuts, beans, fish, chicken, dairy products, soy, grains, lentils, cucumber etc.

Basic pharmacokinetics of phosphorus (based on human intake in natural food products): -

It is absorbed 70-85%, it is absorbed 30% in duodenum, 20% in jejunum, 35% in ileum; it is absorbed in inorganic phosphate form by 2 separate process first when the phosphorus intake is high mainly after meals by paracellular sodium independent passive diffusion pathway & second is transcellular sodium dependant carrier-mediated pathway this falls under the control of vitamin D & etc. When calcium level is too high in the body phosphorus is less absorbed, optimum calcium : phosphorus ratio is helpful in its absorption (excess of anyone decreases the absorption of both). It is stored in bones 85% & rest in tissues; it is excreted 80% in urine & rest in stools (excretion of it is a regulatory action of parathyroid hormone (PTH), vitamin D, and fibroblast).

Basic clinical pharmacology of phosphorus: -

It is present in nature combined with oxygen as phosphate. It acts on growth of teeth, bones, repairs of cells & tissues. It plays an important role in metabolism of carbohydrate, fats, protein & ATP. It works with B-complex vitamins & helps kidney function, muscles contraction, normal heart beats, nerve impulse etc.

- ***Calcium: -***

It is natural essential mineral for the body, it is among the electrolytes of the body; its symbol is Ca & atomic no. 20.

Main sources of calcium: -

It is present in watermelon, quince, milk, banana, cheese, green leafy vegetables, soya beans, nuts, fish, meat, egg, bread, flour, yogurt, almonds, kale, soybean, spinach, cucumber etc.

Basic pharmacokinetics of calcium (based on human intake in natural food products): -

Calcium is absorbed in duodenum & upper jejunum (when calcium intake is low) by transcellular active transport process, this depends on action of calcitriol & intestinal vitamin D receptors & when calcium intake is high, absorbed by paracellular passive process throughout the length of small intestine by 3 major steps, entry across the brush border, intracellular diffusion via calcium-binding protein & extrusion; Vitamin D is necessary for absorption of calcium, also vitamin C, E, k, magnesium & exercise increases the absorption of calcium. Also the level of calcium is regulated by calcitonin released by thyroid gland it reduces calcium level in blood when it is excessive & increases the excretion of calcium via kidneys; Parathyroid hormones (PTH) released by parathyroid gland increases the blood level of calcium when body need it or calcium is less in blood & promotes reabsorption of it in kidneys (calcitonin & PTH both have opposite function). Intestines can absorb 500 to 600 mg of calcium at a time; it is mostly stored in bone tissues & teeth & excreted in stool & sweat & little in urine depended upon the level of it in blood. Also estrogen act on transport of blood calcium in bones thus women mostly suffer from osteoporosis after menopause.

Basic clinical pharmacology of calcium: -

Calcium acts on bone health, communication between brain & other parts of the body, muscles contraction, blood clotting; it is a co-factor for many enzymes, it relaxes the smooth muscles & blood vessels; it maintains heart rhythm, muscles function; it is more needed in childhood & deficiency of it in childhood may cause convulsions (seizure); Excessive level of it in blood is called as hypercalcemia & may lead to kidney stone formation, heart attack, stroke, loss of appetite, excessive urination, memory loss etc; its low level in blood is called as hypocalcemia & may lead to cramps in the body, weak bones, weak teeth, numbness, tingling etc.

Contraindication: -

Sarcoidosis, excessive level of calcium in blood, very severe constipation, kidney stones, increased activity of parathyroid gland etc. Hypersensitivity of calcium, severe cardiac diseases, hypercalcemia, hypercalciuria, severe kidney stones etc.

- ***Iron: -***

It is an essential mineral for our body; its symbol is Fe & atomic no. 26; it is an important component of heamoglobin (heamoglobin binds oxygen in lungs & supply it to whole body, it is oxygen carrier).

Main sources of iron: -

It is present in watermelon, quince, meat, dates, spinach, egg, nuts, dark leafy green vegetables, broccoli, pumpkin seeds, chicken, legumes, fish, banana, cabbage, kidney, almonds, cucumber etc.

Meat is the best source of iron, it provides Fe+2 directly which can be transported from intestine to blood steam through Fe+2 transporter ferroportin (this binds with transferring & delivered into tissues).

Basic pharmacokinetics of iron (based on human intake in natural food products): -

The absorption of iron is not known fully; about only 10% of iron taken in food is absorbed; it is absorbed in duodenum & upper jejunum mainly & at the end part of ileum; low pH is needed for its absorption, after absorption it get bind to transferring (each transferring can carry 2 atoms of iron); ceruloplasmin (protein) also helps in binding of iron; Hepcidin a hormone produced by liver is released when iron stores are full & inhibits iron transport & binding, thus reduces the absorption of iron; vitamin C & copper enhances iron absorption.

Storage of iron: -

Iron is stored in liver (in hepatocytes & kupffer's cells) kupffer's cells play an important role in recycling body iron, they ingest aged RBC liberate iron for it & reuse by breaking down heamoglobin. Little iron is stored in liver, heart, & kidneys in form of ferritin also little in bone marrow, spleen.

Excretion of iron: -

The body does not possess a physiological mechanism for regularly eliminating iron from the body because most of it is recycled by liver cells; iron is lost within cells, from skin & interior surface of the body (intestines, urine, breathe).

Basic clinical pharmacology of iron: -

It is an important component of Haemoglobin (heamoglobin bind oxygen in lungs & supply it to whole body); iron is beneficial for nails, hair, skin etc; it acts on blood production, its deficiency causes Anaemia (low haemoglobin level in blood) (this causes reduced in oxygen carrying capacity & supply of it); most of the iron is present in haemoglobin, it consist of one heme (iron), one protein chain (globin) this allows it to bind & load oxygen from the lungs & supply it to whole body.

Unbounded or free iron is highly destructive & dangerous it can trigger free radical activity which can cause cell death & destroy DNA.

- ***Vitamin K: -***

It is a fat soluble vitamin; it is essential for normal blood clotting; it occurs naturally in two forms, vitamin K1 (phylloquinone) which is widely distributed in plants; it is present in olive oil; Leafy vegetables are good sources of K1; vitamin K2 (menaquinones) is synthesized in alimentary tract by bacteria (Escherichia coli & other bacteria).

Main sources of vitamin K1: -

It is present in olive oil & also present in green leafy vegetables (spinach, kale etc) cauliflower, cabbage, broccoli, sprout, fish, liver, meat, egg, cereals etc.

Basic pharmacokinetics of vitamin k (based on human intake in natural food products): -

It is absorbed in small intestine, bile is required for it absorption & stored in fatty tissues & liver; it is excreted 40% to 50% in stools & 30% to 40% in urine.

Basic clinical pharmacology of vitamin K: -

It acts on synthesis of certain proteins that are prerequisites (necessary) of blood coagulation (means act on stop bleeding) & body also needs it to control the binding of calcium in bones & other tissues. Deficiency of it makes bones weaker, calcification of arteries & other tissues thus take care of bones, joints & heart; it reduces tumour growth & is helpful in cancers.

- ***Vitamin E: -***

It is fat soluble vitamin; it is a group of eight fat soluble compounds that includes four tocopherols & four tocotrienols.

Main sources of vitamin E: -

It is present in olive oil, almonds, cereals, wheat germ, sunflower oil, corn oil, soybean oil, peanuts, green leafy vegetables & etc.

Basic pharmacokinetics of vitamin E (based on human intake in natural food products): -

It is absorbed in small intestines & metabolized in liver & distributed through lymphatic system & stored in fat droplets of adipose tissue cells; it is mainly excreted in stool, little in urine & through skin.

Basic clinical pharmacology of vitamin E: -

It prevents coronary heart disease, supports immune system, prevent inflammation, promotes eye health, lowers the risk of cancer; It is a powerful anti-oxidant thus reduces UV damage of skin, nourishes & protects the skin when applied on face; also promotes hair growth.

- ***Vitamin C: -***

It is also called as Ascorbic acid; it is an essential water soluble vitamin, very much needed by the body for many functions & absorption etc.

Main sources of vitamin C: -

It is present in watermelon, citrus fruit, broccoli, cauliflower, sprouts, capsicums, papaya, strawberries, spinach, green & red chillies, cabbage, leafy vegetables, tomato, cereals, quince, cucumber etc.

Basic pharmacokinetic of vitamin C (based on human intake in natural food products): -

It does not need to undergo digestion, 80 to 90% of it eaten is absorbed by intestine cell border by active transport & passive diffusion & through ion channels it enters the plasma via capillaries. It is very little stored in adrenal glands, pituitary gland, brain, eyes, ovaries, testes, liver, spleen, heart, kidneys, lungs, pancreas & muscles. All together body can store 5 grams of it & we need 200mg/day in order to maintain its normal level & uses, but old, disease person, smokers & alcoholic need more daily value. It is excreted in urine in the form of dehydroascorbic acid changed by liver & kidneys both, but unused vitamin C is excreted intact.

Basic clinical pharmacology of vitamin C: -

It prevent cough & cold, repairs tissue, acts as an enzyme for curtain neurotransmitter, important for immune function, it is a powerful antioxidant (donates electron to various enzymatic & non-enzymatic reactions); body prepares collagen with the help of vitamin c; it is also helpful in Alzheimer's, dementia, acts on iron absorption, it protects the body from oxidative damages, reduces stiffness of arteries, reduces tendency of platelets to clump each other, improves nitric oxide activity (dilatation of blood vessels) thus prevents high blood pressure & heart disease, also prevent eye disease, reduces risk of cataract, prevents the lining of lungs & prevents lung disease, it is a natural antihistamine (anti allergy), eliminates toxins from the body. Deficiency of it causes Scurvy disease (brown spots on skin occurs, swelling of gums, bleeding from all mucous membrane, spots are more on thighs & legs, the person looks pale, feel depressed, cannot move, loss of teeth, suppurative wounds occur.

- ***Vitamin B1 (Thiamin): -***

It is called as Thiamin also; it is a water soluble vitamin, it belongs to B-complex family, it is an essential micro nutrient which cannot be made by our body.

Main sources of vitamin B1: -

It is present in watermelon, spinach, legumes, banana, quince, wheat germ, liver, egg, meat, dairy products, nuts, peas, fruits, vegetables, cereals, rice, breads, oats etc.

Basic pharmacokinetic of vitamin B1 (based on human intake in natural food products): -

Intestinal phosphatases hydrolyze thiamin to make it free & absorbed in duodenum, jejunum mainly through active transport in nutritional doses & passive diffusion in pharmacological doses, very little is known about its absorption; it is metabolized in liver; it is excreted in urine & stored little in liver, heart, kidney, brain, muscles.

Clinical pharmacology of vitamin B1: -

It is needed for metabolism of glucose, amino acids (proteins), lipids (fats) etc; every cell of the body require it to form ATP (adenosine triphosphate) as a fuel for energy, also it enables the body to use carbohydrates as sources of energy; also nerve cells, heart cells, muscles cell require it to function normally; its deficiency causes beri-beri heart disease, weight loss, confusion, malaise, optic neuropathy, irritability, memory loss, delirium, muscles weakness, loss of appetite, tingling sensation in arms & legs, blurry vision, nausea, vomiting, reduce refluxes, shortness of breath etc; it is helpful to immune system; excessive intake of carbohydrates, protein, glucose (speacially in body builders, athletes etc) increases the need of vitamin B1.

- ***Vitamin B2: -***

It is also called as Riboflavin, it is a water soluble vitamin, it is an essential micro nutrient, it helps many systems of the body; it is not synthesized in human body.

Main sources of vitamin B2: -

It is present in watermelon, liver, milk, dairy products, nuts, egg, fish, leafy vegetables, almonds, mushroom, lean meat and quince.

Basic pharmacokinetic of vitamin B2 (based on human intake in natural food products): -

It is phosphorylated in the intestinal mucosa during absorption; mainly absorbed in upper gastrointestinal tract; the body absorbs little from a single dose beyond of 27mg; when excessive amount is eaten it is not absorbed; very little is known about its absorption. The conversion of it into its coenzymes takes place mainly in cells of small intestines, heart, liver, kidneys & throughout the body in many cells; it is excreted in urine & stored little in liver, heart, kidneys & in tissues of the body.

Basic clinical pharmacology of vitamin B2: -

It is needed by the body to keep skin, eyes, nerves, red blood cells healthy, it also helps adrenal gland, nerve cells, heart, brain to function; it also act in metabolism of food, amino acids (protein), fats, helps to convert carbohydrate into energy (Adenosine triphosphate formation- the energy body runs on). It plays an important role in functioning of mitochondria.

Its deficiency is called as Ariboflavinosis & causes weakness, throat swelling, soreness of mouth & tongue, cracks on skin, dermatitis, anemia, weak vision, itching & irritation in eyes, migraine.

- ***Vitamin B6: -***

It is also called as pyridoxine; it is involved in many aspects of macronutrients metabolism; it is present in many food products naturally.

Main sources of vitamin B6: -

It is present in watermelon, quince, chicken, bread, egg, vegetable, soyabean, whole grain cereals, brown rice, fish, legumes, beef, nuts, beans, liver, citrus fruits, starchy vegetables, potato etc.

Basic pharmacokinetic of vitamin B6 (based on human intake in natural food products): -

It is absorbed in small intestines, but before absorption a phosphate group has to be removed making vitamin B 6 in free form & absorbed by passive transport, now reaches liver via portal vein, in liver to get metabolized & flown into the blood stream it is bound with albumin & some are taken up by red blood cells, once getting in blood it can function & promote health & it is excreted mainly in urine & little is excreted in stools, it is very little stored in tissues, muscle tissues, liver, brain, kidneys, spleen.

Basic clinical pharmacology of vitamin B6: -

It is needed for proper development & function of brain in children; it is needed for neurotransmitter, histamine, haemoglobin synthesis & function. It serves as coenzyme (cofactor) for many reactions in the body, it is the master vitamin for processing amino acids & some hormones, it is needed by the body to prepare serotonin, melatonin & dopamine, it is better to intake it during treatment of tuberculosis. It supports adrenal glands to function; it acts as a coenzyme in the breakdown & utilization of fats, carbohydrates, protein, it is important for immune system, it helps in treatment of nerve compression like carpal tunnel syndrome, premenstrual syndrome, depression, arthritis, high homocysteine level, diabetes, asthma, kidney stones etc.

Its deficiency causes seborrheic dermatitis (eruption on skin), atrophic glossitis with ulceration, conjunctivitis, neuropathy, anaemia etc.

- ***Lauric acid: -***

Lauric acid or systematically, dodecanoic acid, is a saturated fatty acid with a 12-carbon atom chain; it is also used for preventing the transmission of HIV from mothers to children. Other uses for lauric acid include treatment of bronchitis, gonorrhea, yeast infections, chlamydia, intestinal infections caused by a parasite called Giardia lamblia, and ringworm.

- ***Capric acid: -***

Capric Acid is a saturated medium-chain fatty acid with a 10-carbon backbone. These properties make caprylic acid a helpful treatment for many conditions. It's used to treat yeast infections, skin conditions, digestive disorders, and high cholesterol.

- ***Citric acid: -***

Citric acid is a weak organic acid that has the chemical formula C 6H 8O 7. It occurs naturally in citrus fruits. Benefits of citric acid are: when applied to skin, citric acid can slough off dead skin cells and speed new cell turnover. The latter promotes new skin growth that can help alleviate the appearance of age spots, acne scars, small wrinkles and areas of uneven tone and texture.

- ***Pectin: -***

Bananas are also a good source of other types of fiber, such as pectin. Some of the pectin in bananas is water-soluble. When bananas ripen, the proportion of water-soluble pectin increases, which is one of the main reasons why bananas turn soft as they age; this pectin is used in medicine making.

- ***Melatonin: -***

Melatonin is a natural hormone made by your body's pineal gland. This is a pea-sized gland located just above the middle of the brain. During the day the pineal is inactive. When the sun goes down and darkness occurs, the pineal is "turned on" by the SCN and begins to actively produce melatonin, which is released into the blood. As a result, melatonin levels in the blood rise sharply and you begin to feel less alert. Sleep becomes more inviting. Melatonin levels in the blood stay elevated for about 12 hours - all through the night - before the light of a new day when they fall back to low daytime levels. Daytime levels of melatonin are barely detectable. Fruits and vegetables like tart cherries, corn, asparagus, tomatoes, pomegranate, olives, grapes, broccoli, cucumber & Grains like rice, barley, rolled oats & Nuts and Seeds like walnuts, peanuts, sunflower seeds, mustard seeds, flaxseed. It has lot of health benefits & made in our body, along with all benefits it is anti-aging.

- ***Serotonin: -***

Serotonin is a chemical that has a wide variety of functions in the human body. It is sometimes called the happy chemical, because it contributes to wellbeing and happiness. The scientific name for serotonin is 5-hydroxytryptamine, or 5-HT. It is mainly found in the brain, bowels, and blood platelets. Serotonin found in bananas doesn't cross the blood-brain barrier, which means it can't get into the brain to supplement the serotonin that's naturally produced by the body. Please read about amino acid tryptophan.

- ***Absorption & digestion of amino acid.***

When we eat high-protein foods, body breaks down protein into amino acids and peptides through digestive enzymes, such as pepsin & pancreas produces trypsin, chymotrypsin and other that aid in protein digestion.

Pepsin is the primary enzyme responsible for digesting protein; it acts on the protein molecules & breaks the bonds – called peptide bonds – that hold the protein molecules together. Next, these smaller chains of amino acids move in the stomach & then in small intestine where they're further broken down by enzymes released by the pancreas. Small intestine contains finger-like extensions called micro-villi. These structures enhance its ability to absorb dietary nutrients. Now the semi digested material pass

through brush border and baso-lateral membranes of small intestine & di-tripeptides are absorbed by passive transport (facilitated or simple diffusion) or active transport (Na+ or H+ co-transporters) pathways. Di and tripeptides are more efficiently absorbed than free amino acids which in turns are better absorbed than oligopeptides. They're released into the bloodstream and used for various biochemical reactions.

Each amino acid has a different role in the human body. Upon absorption, some amino acids are incorporated into a new protein. Some fuel your muscles and support tissue repair. Others are used as a source of energy.

Tryptophan and tyrosine, for example, promote brain health. These amino acids support the production of neurotransmitters, leading to increased alertness and optimum nerve responses. Tryptophan also assists with serotonin production, lifting your mood and keeping depression at bay.

Phenylalanine serves as a precursor to melatonin, epinephrine, dopamine and other chemicals that regulate your mood and bodily functions. Methionine helps your body absorb selenium and zinc, two minerals that promote overall health. Some amino acids, such as isoleucine, play a vital role in hemoglobin production and glucose metabolism.

- ***Tryptophan: -***

It is an amino acids (protein) that is useful in bio-synthesis of protein; it is essential in human because body cannot make it); it is a precursor of neuro-transmitter serotonin, melatonin, vitamin B3; it is a sedative also.

Main sources of tryptophan: -

Salmon oil, egg, spinach, milk, seeds, fenugreek seed, soy products, nuts, fish, meat, wheat, banana etc.

Basic pharmacokinetics of tryptophan (based on human intake in natural food products): -

It is absorbed in small intestine & reached the blood circulation, it passes the blood brain barrier & in brain cells it is metabolized into indolamine neuro-transmitter, niacin, a common example of indolamine is serotonin derivative from tryptophan. Tryptophan is converted into serotonin in the brain & body; it is believed that tryptophan supplements should be taken with carbidopa, which blocks the blood brain barrier. (Serotonin (5HTP) 5 hydroxytryptamine, is a monoamine neuro-transmitter. It contributes in feelings of well-being, happiness, reward, learning, memory, many physiological functions).

In the pathway of tryptophan/serotonin, melatonin hormone is produced. Melatonin regulates sleep-wake cycle. It is primarily released by pineal gland in brain. It controls circadian (daily clock) rhythms.

Pineal gland releases it at night more & very little in day light. It improves immune system function.

Natural sources of melatonin are tomato, pomegranate, olive, grapes, broccoli, cucumber, barley, seeds, nuts etc.

Fructose malabsorption causes improper absorption of tryptophan in intestine thus leading to low level of it & may cause depression.

Basic clinical pharmacology of tryptophan: -

It is necessary for normal growth of infants; nitrogen balance in adults, it aids in sleep pattern, mood. It is necessary for melatonin & serotonin formation in body, it enhances mental & emotional well being, manages pain tolerance, weight etc. it also helps in build muscle tissue, essential for vitamin B3 production, relives insomnia, reduces anxiety, depression, migraine, OCD, helps immune system, reduces cardiac spasms, improves sleep patter etc.

- ***Threonine: -***

It is an amino acid used in biosynthesis of proteins; it is an essential amino acid important for tooth enamel, collagen, elastin, nervous system, fats metabolism, it prevents fats buildup in liver, useful in intestinal disorders, anxiety, and depression.

Main sources of threonine: -

Cheese, chicken, fish, meat, lentil, black seed, nuts, soy etc.

Basic clinical pharmacology of threonine: -

It is useful in nervous system disorders, multiple sclerosis, spinal spasticity, makes bones, joints, tendons, ligament stronger, it helps the immune system, promotes heart health.

- ***Isoleucine: -***

It is an amino acid that is used in the biosynthesis of proteins, it is an essential amino acid means the body cannot make it & we depend on food sources, it plays & helps many functions of the body.

Main sources of isoleucine: -

Meat, mutton, fish, cheese, egg, seeds, nuts, soybeans, milk, legumes, fenugreek seed etc.

Basic pharmacokinetics of isoleucine (based on human intake in natural food products): -

It is absorbed in small intestine by sodium-dependant active transport. It is metabolized in liver.

Basic clinical pharmacology of isoleucine: -

It promotes glucose consumption 7 uptake, it is anti-catabolic, enhances athletic performance & best for pre-workout, it acts on wound healing, detox of nitrogenous waste in the body, stimulates immune system, promotes secretion of many hormones, helps in heamoglobin formation, regulating blood glucose, energy in the body, built muscles, helpful to brain for its function.

- ***Leucine: -***

It is branched chain amino acid (BCAA) it is ketogenic amino acid; it is necessary when we do exercise, it stimulates protein synthesis & assists in muscle building.

Main sources of leucine: -

Cheese, soyabean, meat, nuts, chicken, seeds, fish, seafood, beans.

Basic clinical pharmacology of leucine: -

It helps regulate blood glucose, promotes growth, recovers the muscles & bone tissues, acts on production of growth hormones, repairs the tissues, essential for muscle building, it burns fats, controls obesity, promotes lean muscles growth.

- ***Lysine: -***

It is an essential amino acid, which our body cannot prepare and we need to eat it from food sources. It necessary for many body functions, acts in building blocks of protein (muscles).

Main sources of lysine: -

Red meat, chicken, egg, fish, beans, lentils, wheat germ, nuts, soybeans, spirulina, fenugreek seed, shrimp, pumpkin seed, tuna, cheese, milk etc.

Basic pharmacokinetics of lysine (based on human intake in natural food products): -

It is absorbed from the lumen of the small intestine into the enterocytes by active transport, it undergo first pass metabolism in liver & is metabolized in liver.

Basic clinical pharmacology of lysine: -

It helps the body in tissue growth, repair muscles injury, promote collagen formation, help the body to produce enzymes, antibodies, hormones, supports immune sytem, its deficiency causes fatigue, irritability, nausea, hair loss, anorexia, inhibited growth, anemia, problems with reproductive system, it is very helpful in treating cold sores (herpes), control blood pressure, diabetes, osteoporosis, helps athletes performance, helpful in treating cancers, reduces anxiety, increase absorption of calcium, improves digestion & prevent leaky gut, helpful in pancreatitis.

- ***Methionine: -***

It is a sulfur containing amino acid; it is essential; it plays a critical role in the metabolism & health; it act on normal cell functioning, growth & repair. It is also a chelating agent for heavy metals; due to its sulfur contain it is helpful in hair, nail health & growth & good for skin health; it reduces cholesterol by increase the production of lecithin in liver & reduces fats formation in liver, also protects kidneys, liver from hepatotoxins, it is an antioxidant. It is absorbed in lumen of small intestines into enterocytes by active transport & metabolized in liver.

Main sources of methionine: -

Meat, mutton, fish, chicken, cheese, egg, beans, milk, nuts, shellfish etc.

- ***Cystine: -***

It is the oxidized dimer form of amino acid, it is nonessential; the body uses it to produce taurine & other amino acids; it is a sulfur containing amino acid; our body uses vitamin B6 with the help of cystine; it heals burns, wounds, bronchitis, assist in supply of insulin, it increase level of glutathione in liver, lungs, kidneys & bone marrow. It is anti aging, anti inflammatory, anti arthritis, anti rheumatoid arthritis.

Main sources of cystine: -

Meat, egg, milk, garlic, onion, broccoli, oats, wheat germ, lentils etc.

- ***Phenylalanine: -***

It is an aromatic essential amino acid in human; it plays a key role in biosynthesis of other amino acids; it is important in the structure & function of many proteins & enzymes. It is precursor of melanin, dopamine, noradrenalin hormone, thyroxin hormone. It is converted in tyrosine & used in biosynthesis of dopamine & noradrenalin. It improves memory, reduces pain of hunger; it is anti depressant; it is also a building block protein; it is useful in vitiligo, depression, ADHA, parkinson's, multiple sclerosis, pain, osteoarthritis, rheumatoid arthritis, fat burn & helpful in alcohol withdrawal symptoms.

Main sources of phenylalanine: -

Pumpkin seed, nuts, seeds, soy, meat, fish, chicken, egg, beans, milk etc.

- ***Tyrosine: -***

It is a nonessential amino acid; it is also called as 4-hydroxyphenylalanine; it is useful in cell synthesis of protein; it is a building block protein; body prepares it from phenylalanine. It is a precursor & used to produce noradrenalin, dopamine, & thyroxin & melanin hormones. It reduces stress, improves memory, it promotes growth, mental health, skin health, fat burn. It acts as a mood elevator, anti depressant, improves memory, mental alertness, its deficiency can cause hypothyroidism leading to low blood pressure, low body temperature (hypothermia), stress, fatigue, narcolepsy; it helps thyroid gland, adrenal gland, pituitary gland to function properly. It is absorbed in small intestine by sodium-dependant active transport; after absorption it reaches the blood & crosses the blood brain barrier (BBB) & enters the brain cells & gets metabolized into catecholamine (noradrenalin). Human body regulates it amount by eating it by food sources & making inside the body (nonessential). The body does not store it much for later uses.

Main sources of tyrosine: -

Meat, fish, egg, milk, nuts, beans, oats, wheat, black seeds etc.

Dopamine: -

It regulates reward & pleasure centers in brain; it is a chemical important for memory, motor skills & etc.

Nor-adrenaline & adrenaline: -

These hormones are responsible for fight & flight response in stressful situation & also controls many functions of the body; it is secreted by adrenal glands.

Thyroxin: -

It is secreted by thyroid gland; it regulates metabolism, blood pressure, digestion, energy etc.

Melanin: -

It is pigmented hormone, gives our skin, hair, eye their colour; dark skinned people have more melanin in their skin than light skin people (depend on exposure to sunlight).

- ***Valine: -***

It is an essential nutrient for vertebrates, biosynthesis of protein; it is an aliphatic & extremely hydrophobic essential amino acid; it is branched chain of amino acid (BCAA); it is important for growth, repair, blood glucose regulation, for energy; it stimulates CNS, proper mental function.

Main sources of valine: -

Cheese, soy, beans, nuts, fish, meat, chicken, mushroom, seeds, nuts, whole grains etc.

- ***Histidine: -***

It is an amino acid used in biosynthesis of protein; it is semi essential amino acid, needed by human for production of histamine & also for growth & tissue repair, it is helpful in maintaining myelin sheaths that covers the nerves & protects the nerves.

Main sources of histidine: -

Meat, mutton, fish, milk, egg, seeds, nuts, chicken, cheese, soy, beans, whole grains, fenugreek seeds.

Basic pharmacokinetics of histidine (based on human intake in natural food products): -

It is absorbed in small intestine via active transport requiring the presence of sodium.

Basic clinical pharmacology of histidine: -

It plays many roles in immunity, gastric secretion & sexual functions. It is also required for blood cell formation & protects tissues against damage of radiation & heavy metals. It keeps normal pH of 7 in the body, useful in rheumatoid arthritis, allergy, ulcer & anemia caused by kidney failure or dialysis. It is an antioxidant, anti inflammatory, reduces cholesterol.

- ***Arginine: -***

It is among conditional essential amino acid the body needs to function properly; it is made in liver; it plays an important role in building protein thus helpful in body building.

Main sources of arginine: -

Chicken, pumpkin seeds, spirulina, dairy products, red meat, fish, egg etc.

Basic pharmacokinetics of arginine (based on human intake in natural food products): -

It is absorbed in jejunum mainly from oral diet.

Basic clinical pharmacology of arginine: -

It releases nitric oxide in the blood & nitric oxide dilates the blood vessels thus increases the blood supply & controls high blood pressure, it improves erection, builds muscles etc. it also act on release of growth hormone, insulin & other substances in the body. It also improves heart health, athletes performance, stimulates immune system; citrulline present in watermelon is converted into arginine in kidneys, please refer lesson on watermelon.

- ***Alanine: -***

It is a non essential amino acids that is present in blood plasma in its free state in high levels; it is involved in sugar & acid metabolism, protein synthesis, it increases immunity, provides energy for muscles tissues, brain & CNS, it act on tryptophan, vitamin B6 metabolism; it is an important sources of energy for muscles; it helps the body to convert simple sugar (glucose) into energy; it is produced in the body. It increases exercise capacity; reduces muscle fatigue, boost immunity, it is antioxidant; anti aging; increases muscle growth; ideal pre & post workout, reduce blood sugar, prevent liver disease, helps the liver to eliminate toxins, improves CNS functioning, helpful in benign prostate hypertrophy. It is digested in small intestine; it is converted into pyruvic acid by alanine aminotransferase-1; during fasting condition alanine derived from protein breakdown is converted into pyruvate & used to synthesis glucose by gluconeogenesis in liver, it is excreted in urine via urea cycle. It is stored little in skeletal muscles.

Main sources of alanine: -

Meat, fish, egg, milk, aleovera, honey, black seeds, nuts etc.

- ***Aspartic acid: -***

It is a non essential amino acid; it is over all negatively charged & plays an important role in synthesis of other amino acid, citric acid & urea cycles; it is found in animals, plants, sugarcane, sugarbeet. It may be a neurotransmitter; it strengthens the muscles, improves heart function, helps in maintaining mental health, reduces tiredness, improves athletic performance, increases muscle size, reduces depression & fatigue. It is absorbed in small intestine by active transport.

Main sources of aspartic acid: -

Meat, oysters, seeds, oats, avocado, sugar beet, milk, egg, nuts, cereals etc.

- ***Glutamic acid: -***

It is a nonessential amino acid. It is an excitatory neuro-transmitter; it is necessary for biosynthesis of proteins; body uses it for several key functions within the body like making other neuro-transmitters such as GABA; it promotes brain health, muscles health, intelligence, mood & mental alertness. It is called as chemical messenger. It plays an important role in body's disposal of excessive waste like nitrogen. It is absorbed in lumen of small intestine into enterocytes by active transport & excreted in urine mainly. It is almost about 2 kgs, storage in natural form in brain, kidneys, liver, muscles etc.

Main sources of glutamic acid: -

Meat, chicken, fish, egg, milk, wheat, mushroom, soy, broccoli, walnut, peas etc.

- ***Glycine: -***

It is a nonessential amino acid that body needs for growth & maintainance of tissue & need to prepare hormones & enzymes. It is inhibitory neurotransmitter. It helps in preparing glutathione (a powerful antioxidant & reduces free radicals, delay aging). It is helpful in preparing of creatine (provides energy to muscles to perform exercise etc & acts on muscle contraction), beneficial for brain health, bone health, alzheimer's, schizophrenia, sleep disorder, stroke, burns, protects kidney & liver from harmful side effects of drugs used after organ transplant, heals wound & ulcers, it is anti inflammatory, improves skin health.

Main sources of glycine: -

Meat, fish, milk, legumes etc.

- ***Proline: -***

It is a protein-genic amino acid used in biosynthesis of proteins. It heals cartilages, cushion joints, tendons, ligament, heart muscles, connective tissues & helps in formation of collagen.

Main sources of proline: -

Soy, pumpkin seed, lentils, black beans, quinoa etc.

- ***Serine:-***

It is a nonessential amino acid, important for synthesis of protein, fats metabolism, muscle growth, immune system; it is a precursor of many amino acids, helpful in enzyme catalyze its reaction, overall health, physical & mental health.

Main sources of serine: -

Soybean, egg, lentils, meat, fish, nuts, almonds, walnut etc.

100 grams of banana has following: -			
Calories 89			
% Daily Value*			
Sodium 1 mg			0%
Potassium 358 mg			10%
Total Carbohydrate 23 g			7%
Dietary fiber 2.6 g			10%
Sugar 12 g			
Protein 1.1 g			2%
Vitamin A	1%	Vitamin C	14%
Calcium	5mg	Iron	1%

Vitamin D	0%	Vitamin B-6	20%
Cobalamin	0%	Magnesium	6%

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Also on this website

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^ Jump up to:[a] [b] Paul Frame (January 20, 2009). "General information about K-40". Oak Ridge National Laboratory. Retrieved April 24, 2019. The human body maintains relatively tight homeostatic control over potassium levels. This means that the consumption of foods containing large amounts of potassium will not increase the body's potassium content. As such, eating foods like bananas does not increase your annual radiation dose. If someone ingested potassium that had been enriched in K-40, that would be another story.

- ***Research: -***

The antioxidant property of banana peel extracts *(Musa paradisiaca L.)* was explored using a group of rats exposed to a normal diet and compared to another group fed with fatty acid-rich diet. Oxidation markers like malondialdehyde (MDA) were measured. It was observed that subjects treated with banana peel extract displayed a significant decrease in concentrations of the peroxidation products (MDA), peroxides, as well as conjugated dienes. Meanwhile, antioxidant enzymes, catalase, and superoxide dismutase activities were raised significantly in the treated subjects. The level of an important antioxidant, reduced glutathione (GSH), also increased [22]. In another research conducted by [23], powdered candi banana (*Musa paradisiaca*) was extracted using ethanol and ethyl acetate in an ultrasonic bath. The results indicated that the antioxidant activity (IC_{50}–50% inhibitory concentration) of ethanol extract and ethyl acetate was 3374.13 ± 123.46 and 40318.19 ± 1014.90 ppm, respectively, hence, leading to the conclusion that the antioxidant activity of ethanol extract is higher than that of ethyl acetate.

An *in vitro* antioxidant study of *Musa sapientum, Musa paradisiaca, Musa cavendish,* and *Musa acuminata* peels was conducted using 2,2-diphenyl-1-picrylhydrazyl radical (DPPH), hydrogen peroxide (H_2O_2) radical scavenging assay, and ferric reducing power assay. The results showed that *Musa acuminata* has the highest antioxidant activity followed by *Musa cavendish* against DPPH radical. In ferric reducing power and H_2O_2 scavenging assay, *Musa acuminata* also showed best antioxidant activity when compared with other extracts. The study revealed that the peels of *Musa* species possess

significant *in vitro* antioxidant activity, hence, the conclusion that eating the peel of banana fruit would be beneficial considering its potential antioxidant property [24]. It was also reported that ethanol extracts of unripe Cavendish (*Musa acuminata L)* and Dream banana *(Musa acuminata colla. AAA cv* Berangan) peels have excellent radical scavenging activities with an IC_{50} of 90.28 µg/mL (for Cavendish) and 113.09 µg/mL (for Dream banana). The researchers ascribed this effect to the abundant phenols, flavonoids, and tannins detected in the peel extracts [25]. It can therefore be inferred that the antioxidant compounds like phenols and flavonoids present in the peel are involved in DPPH radical inhibition.

In another study that investigated the antioxidant activity of banana flowers of six distinct Malaysian cultivars, namely *Musa balbisiana* cultivars pisang Abu (P. Abu) and pisang Nipah (P. Nipah); *Musa acuminata* cultivars pisang Berangan (P. Berangan), pisang Susu (P. Susu), and pisang Mas (*P. Mas*); and *Musa paradisiaca* cultivar pisang Rastali (P. Rastali), it was found that, of all the six cultivars, P. Susu possess the highest phenolic content (80.13 ± 4.64 mg of GAE/g of extract) and the highest 2,2'-azido-bis (3-ethylbenzothiazoline-6-sulphonic acid) $ABTS^{+}$ and DPPH free radical scavenging activities. This is indicative of a strong relationship between the phenolic contents and radical scavenging power of the flowers [26]. The study of antioxidant activity of banana parts, namely tepal (methanol, ethanol, and aqueous extracts), peel, and pulp (methanol extracts) as well as pure syringin was carried out using DPPH radical scavenging assay and the result showed excellent antioxidant activity in tepal methanol extract, moderate activity in both tepal and peel ethanol and aqueous extracts. Meanwhile, mild activity was observed in pure syringin and pulp extracts. The DPPH radical scavenging activity of the different successive extracts of *Musa paradisiaca* showed direct proportion with sample concentration and the researchers attributed this role to the abundant phenols and flavonoids present in the extracts (Figure 4) [27]. DPPH and ferric ion reducing antioxidant power (FRAP) assay methods were employed to determine the radical scavenging ability of banana fruit extracts. The extract prepared from ethanol had higher antioxidant activity, while solvent hexane fraction showed moderate scavenging activity. Moreover, banana peels extracted with ethanol demonstrated potent antioxidant activity on DPPH, with an IC_{50} of 19.10 µg/mL. In the same vein, the ethanol extract of the peels exhibited significant antioxidant activity on FRAP with IC_{50} values of 55.10 µg/mL. The pulp extracted with ethanol showed excellent FRAP radical scavenging activity with IC_{50} of 46.40 µM of Fe^{2+}/mg [28]. A comparative study of antioxidant effects of banana and papaya peels was carried out using DPPD and ferric reducing activity methods. The outcome showed clearly that banana peel extract scavenges more free radicals than that of papaya.

- ***Conclusion of research: -***

Bananas are widely used all over the world as food staples and for medicinal purposes. This is for their interesting bioactive secondary metabolites. Phytochemical and pharmacological studies of bananas and plantain are expanding as it has been demonstrated that Musa species extracts possess numerous pharmacological activities, which are ascribed to their phyto-constituents like phenols, carotenoid, and amines. There is a growing interest in developing a banana-based phyto-medicine for wound healing and treating Parkinson's disease, considering the ethno-pharmacological data available on the potentials of banana fruit. To achieve that, issues such as modality, quality control, efficacy, safety, and toxicity need to be addressed at both preclinical and clinical levels. Finally, looking at the genetic diversity of banana species and its adaptation to different environmental conditions, ethno-pharmacological investigations will provide the suitable support needed for clinical usage of secondary metabolites of banana species in modern medicine. Furthermore, thorough phytochemical screening needs to be undertaken to ascertain the active components in different types of extracts of banana parts. This will enrich the literature and provide a solid base for scientific arguments as against the current reliance on empirical and anecdotal assumptions.